MACHINERY

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Brussels

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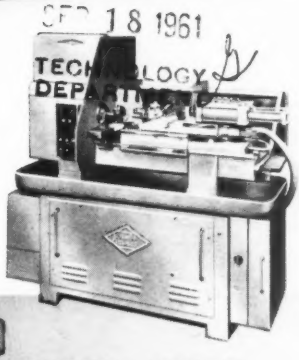

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UNIVERSAL HOBBERS

V.10 Built-in differential. Hob head swivels to 60° for spiralling. Lever operated change-over roughing to finishing feeds. 10" dia., 8" face, 7 DP.

H.7 For long splines, taper hobbing and high angle spirals. Built-in differential. 19" hobbing length. 8 DP. Spindle bored 3".

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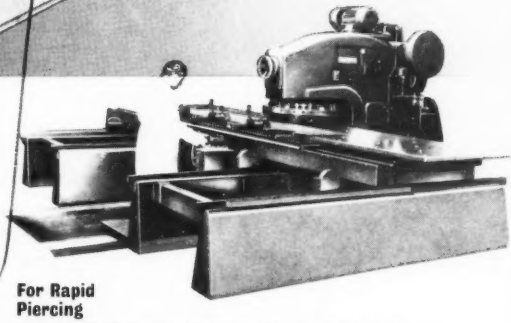

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R.61 Co-ordinate positioning by direct reading counters. 20 turret stations. 80,000 lb. capacity. Punches up to 6" dia. in ⅛" mild steel plate. Max. Sheet size 100" x 60".

RA. 41P With 24" x 24" pantograph table and stylus for rapid location of centres from templates made on the machine. 18 turret stations. Capacity 30,000 lb. Punches up to 3" dia. in ·074" mild steel plate.

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PATENT NO. 748778

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Due to Centre Trunnion Design

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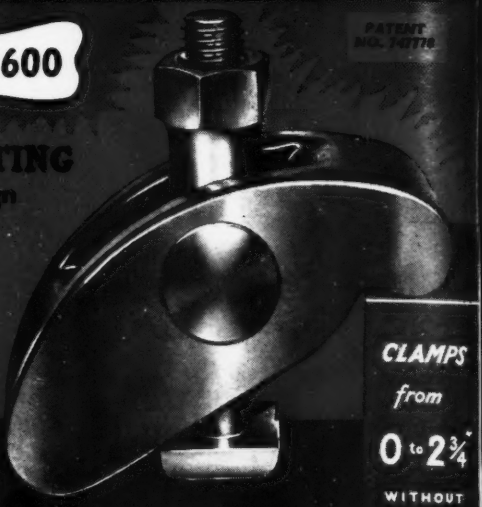

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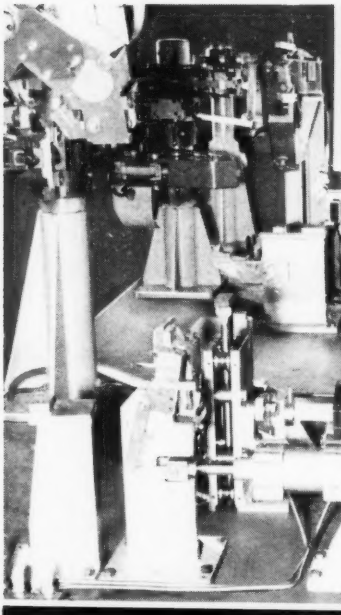

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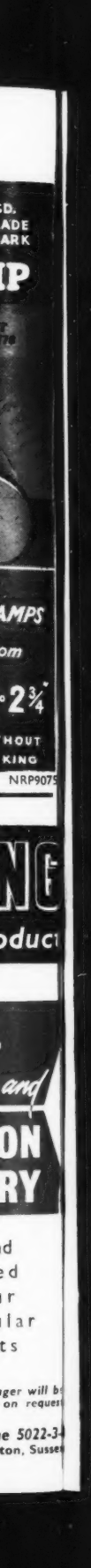
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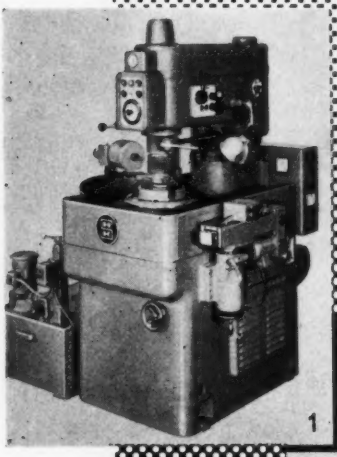
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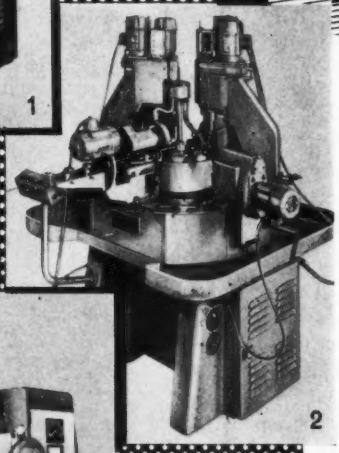
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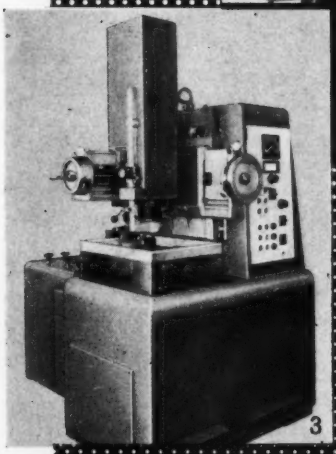
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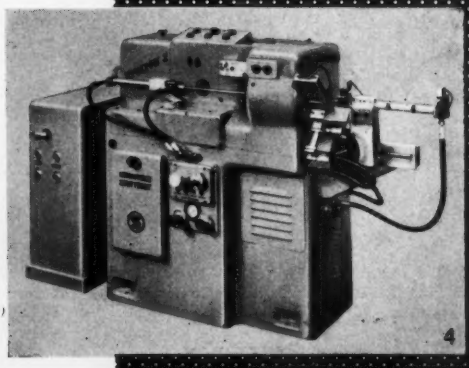
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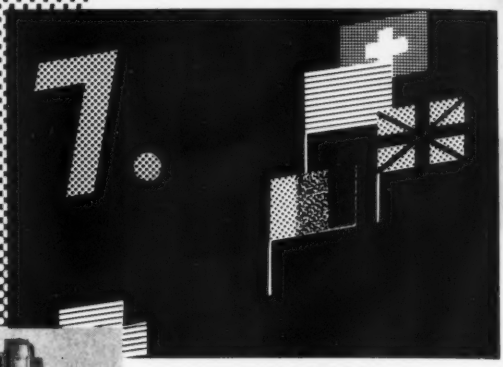

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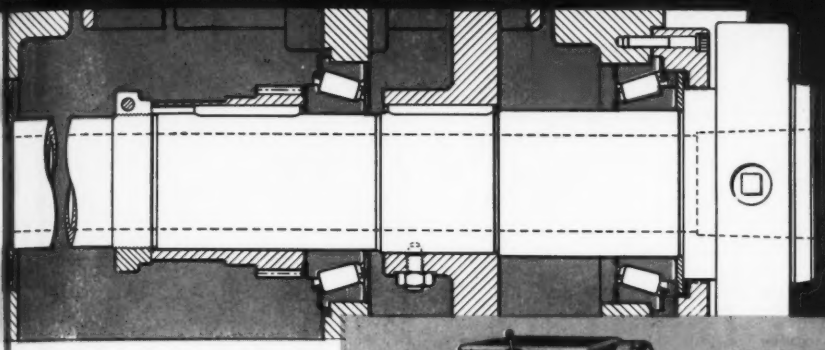

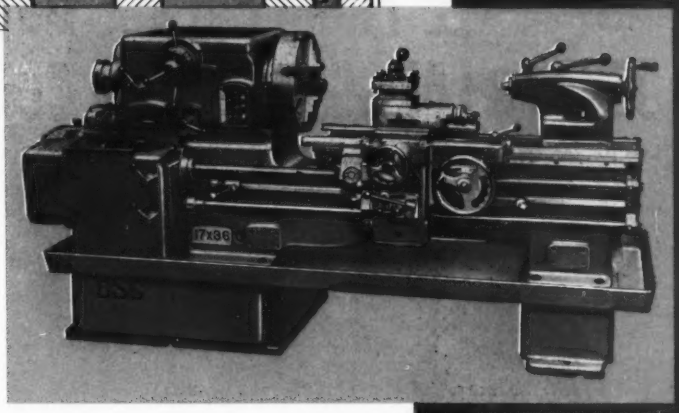

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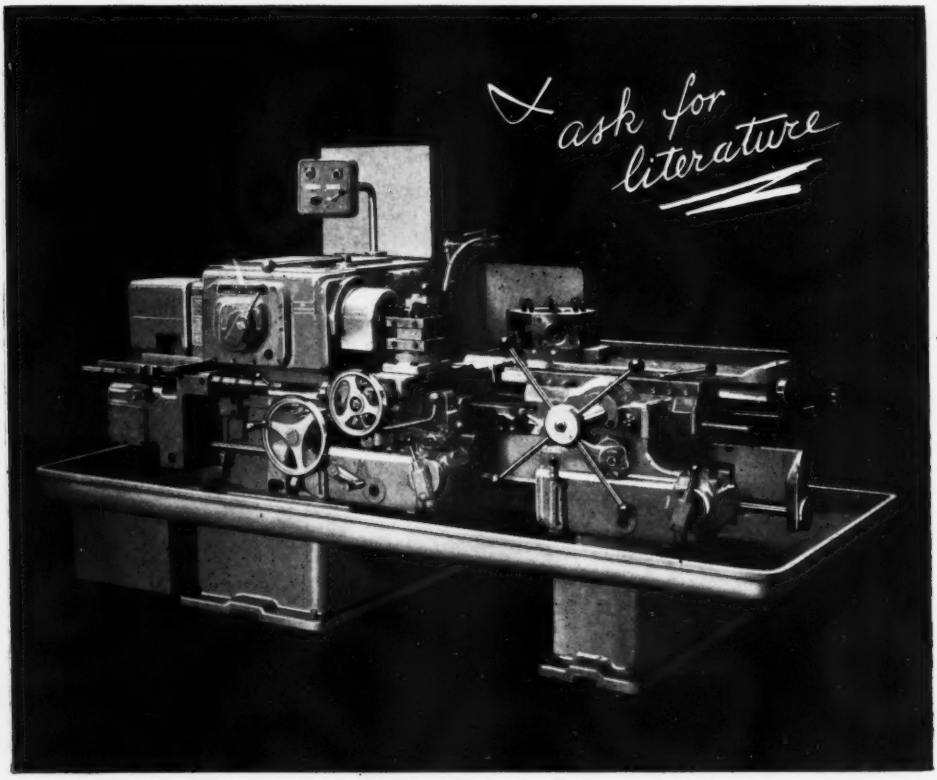

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Favourable delivery dates.

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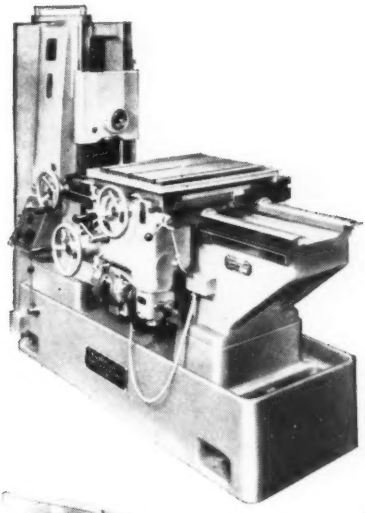

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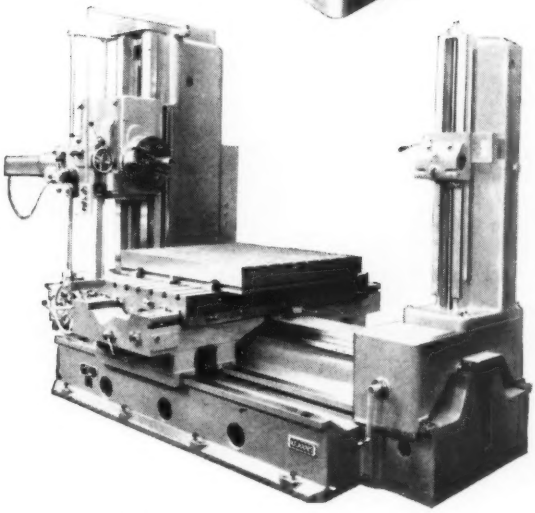

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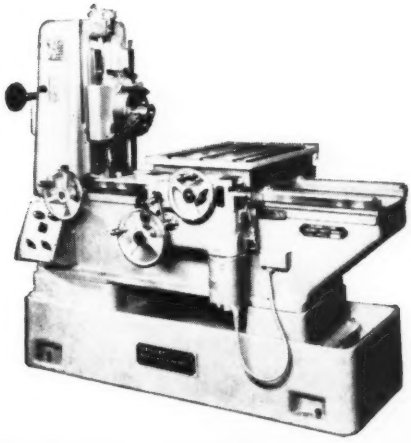

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The pressing assembly
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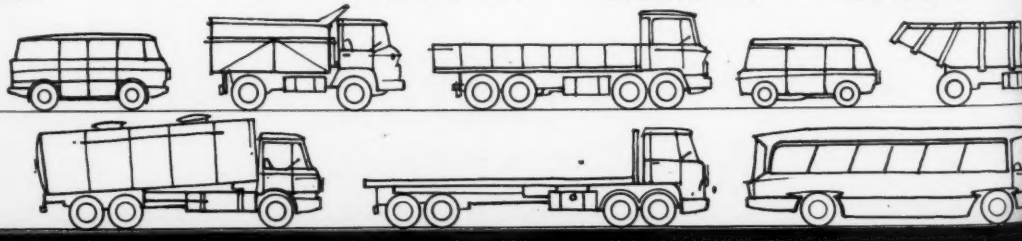

KINS & MITCHELL PRESSES (350, 400, 600, 800 tons capacity) at Willenhall Motor Radiator producing the pressings shown.

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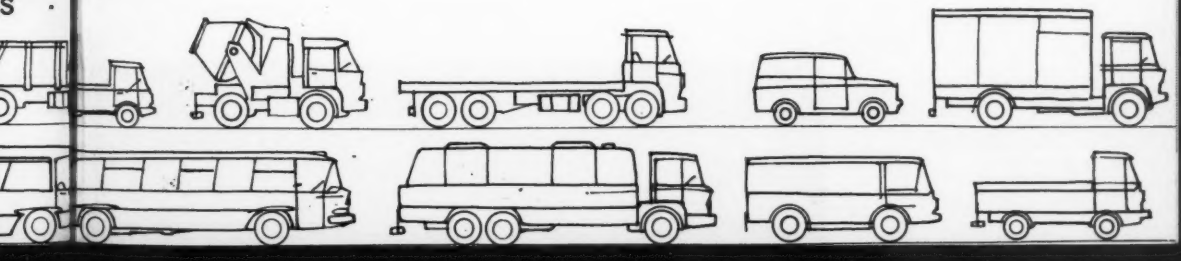

Galtona

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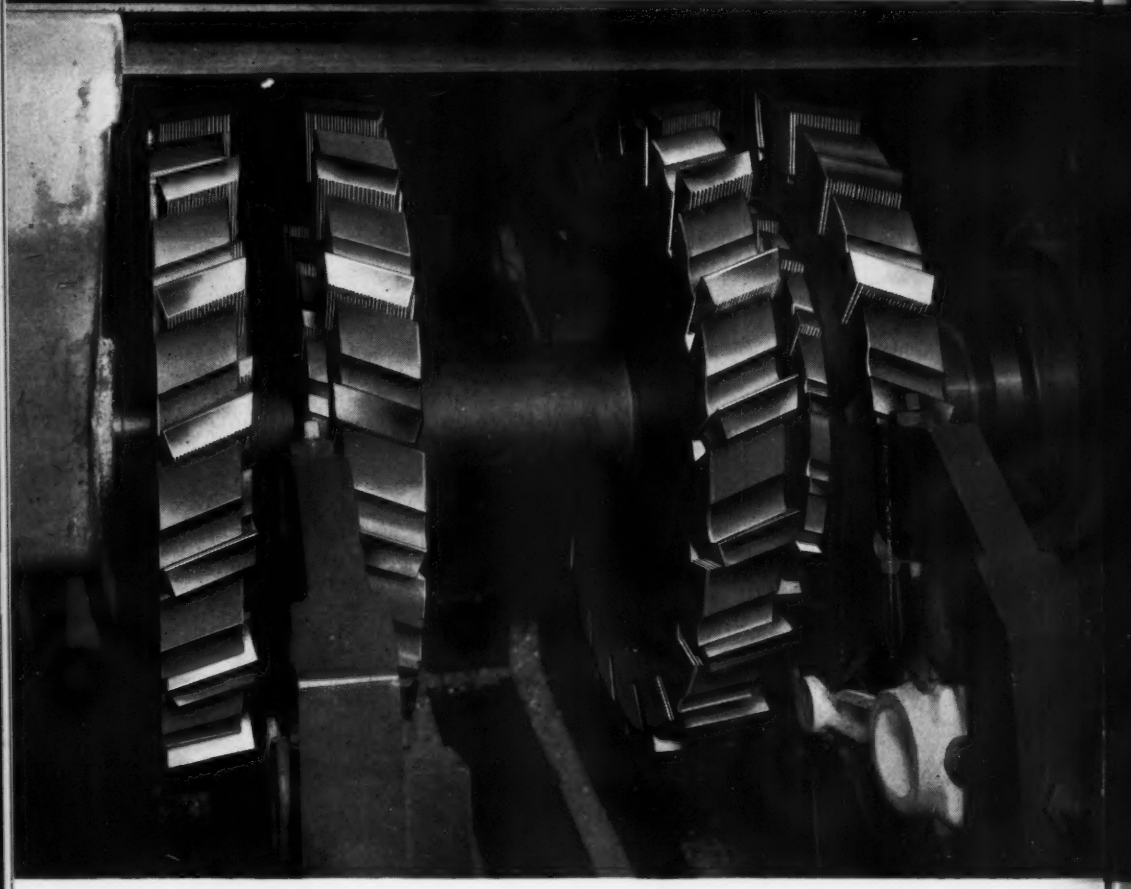
CUTTERS . . . . . A



CUTTING OPERATION (Above)

One of many operations for which Douglas (Kingswood) Limited rely on GALTONA serrated blade cutters is the gang milling of air compressor connecting rods as shown. The ability of GALTONA cutters to maintain uniform performance, combined with high cutting power is a big factor contributing to their ever extending application in the engineering industry

TAPPING (Right)

We illustrate, at right, the production tapping of air compressor cylinder heads on a Ward capstan lathe. On this job GALTONA ground thread taps have proved dependable for consistent performance and long life precision. The range of GALTONA ground thread taps covers both solid and inserted blade types. Complete details will be sent on request.

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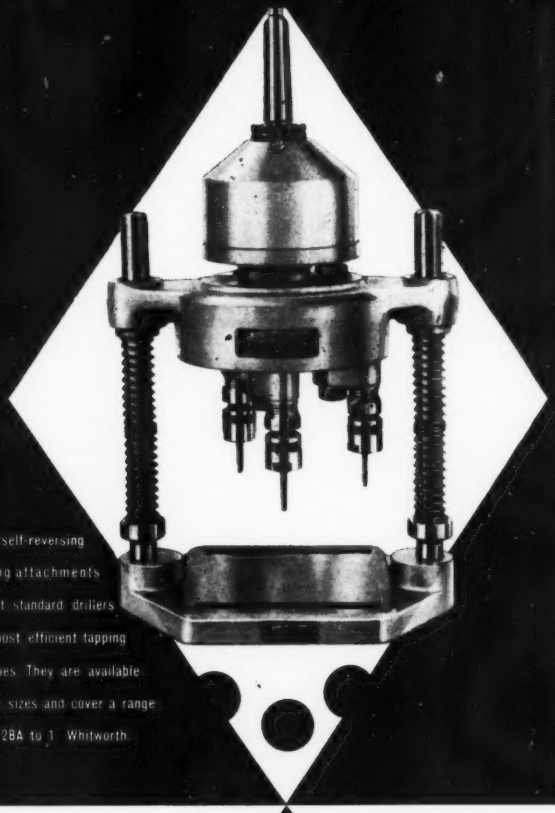
Self reversing multi-spindle tapping attachments are supplied with two, three or four adjustable spindles. They are available in two sizes and cover a range from ½" minimum centres to 5" maximum pitch circle diameter. Max. capacity ¾" Whitworth.



These self-reversing tapping attachments convert standard drillers into most efficient tapping machines. They are available in four sizes and cover a range from 12BA to 1" Whitworth.

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Adjustable centre multi-spindle drilling attachments increase the productivity of standard drilling machines, and we have a range of 41 standard attachments available to meet customers' requirements.

Illustrated are Fig. 199 two and three spindle heads with spindles bored to take No. 1 morse taper shank drills. This model is also available with four spindles, maximum pitch circle diameter 6½".

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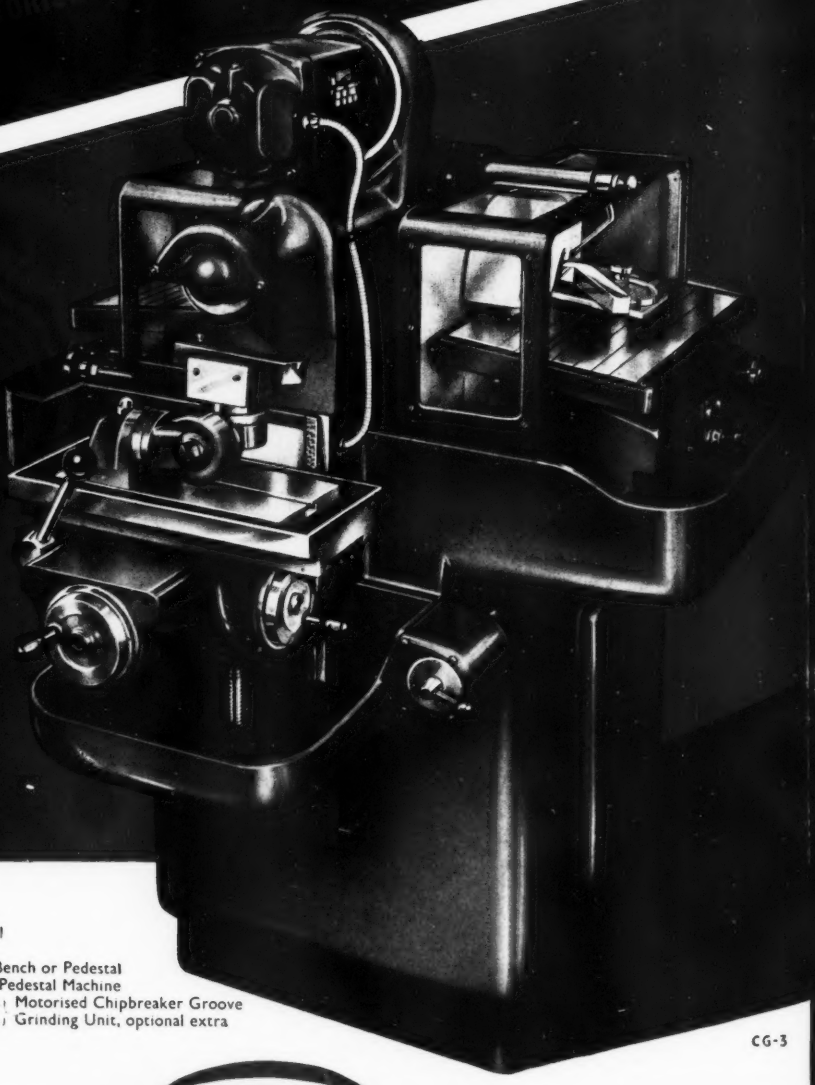

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CG-3

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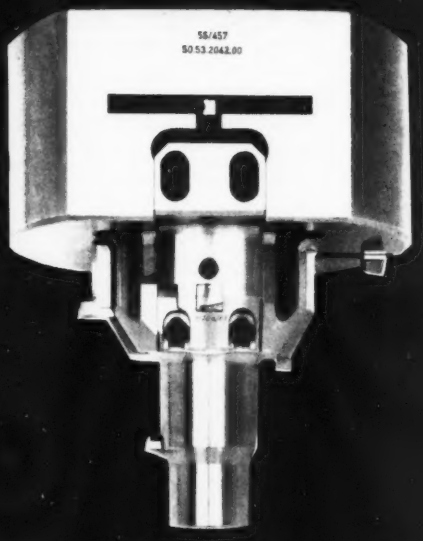

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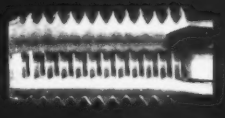

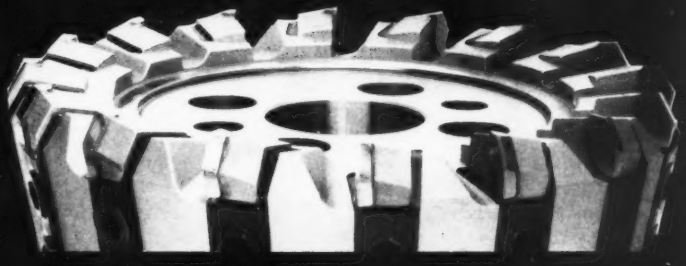

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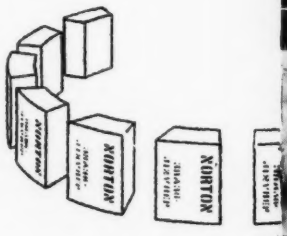

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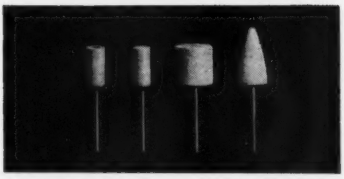

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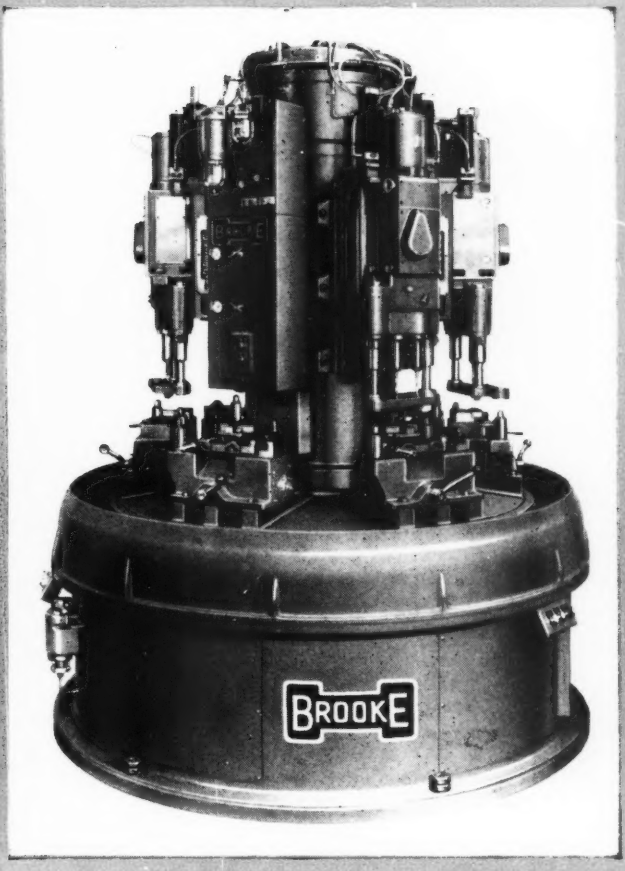
TABLE ON AIR-FLOTATION, HYDRAULIC OR AIR POWERED

QUICK RE-TOOLING AT LOW COST

ECONOMIC USE OF FLOOR SPACE



We are exhibiting at the
7th European Machine Tool
Exhibition in Brussels
from September 3 - 12, 1961.
Stand No. 4329
Hall No. 4

BROOKE TOOL AUTOMATION LTD.

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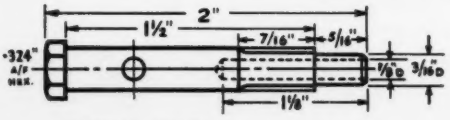
TYPE 00B

CHAIN DRIVEN BALL-BEARING SPINDLE WITH A MAXIMUM SPEED OF 7200 R.P.M.

- ¼in. BAR CAPACITY ● 1½in. TURNING LENGTH
- ALL NEW TURRET SLIDE WITH CONSTANT WITHDRAW OF 25/32in. CAN BE FITTED WITH RAPID PULL OUT ATTACHMENT FOR DEEP HOLE DRILLING
- GREATER TOOL & SWARF CLEARANCE
- NEW LUBRICATOR SUPPLIES OIL TO ALL BEARINGS
- ATTACHMENTS FROM PREVIOUS MODELS FIT OOB
- PUSH BUTTON STATION FOR START, STOP & INCH



MATERIAL: LEDLOY

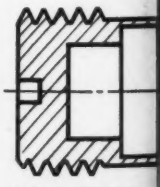
EQUIPPED WITH CAMS AND TOOLING TO PRODUCE THIS STEEL COMPONENT IN 22 SECS. THE MACHINE IS FITTED WITH RAPID PULL OUT VERTICAL SLIDE, BRAKE IN NEUTRAL, CROSS DRILLING AND FLASHING STOPLIGHT ATTACHMENTS.

TYPE 00C

CHAIN DRIVEN NON-REVERSING BALL BEARIN SPINDLE WITH A MAXIMU SPEED OF 10,000 R.P.M.

- ¼in. BAR CAPACITY ● 1½in. TURNING LENGT
- ALL NEW TURRET SLIDE WITH CONSTAN WITHDRAW OF 25/32in. CAN BE FITTED WI RAPID PULL OUT ATTACHMENT FOR DEEP HO DRILLING
- GREATER TOOL & SWARF CLEARANCE
- NEW LUBRICATOR SUPPLIES OIL TO ALL BEARIN
- ATTACHMENTS FROM PREVIOUS MODELS FIT OC
- PUSH BUTTON STATION FOR START, STOP & INC

EQUIPPED WITH CAMS AND TOOLING TO PRODUCE THIS BRASS COMPONENT IN 2 SECS. THE OOC IS FITTED WITH VERTICAL SLIDE AND SCREW SLOTTING ATTACHMENTS.



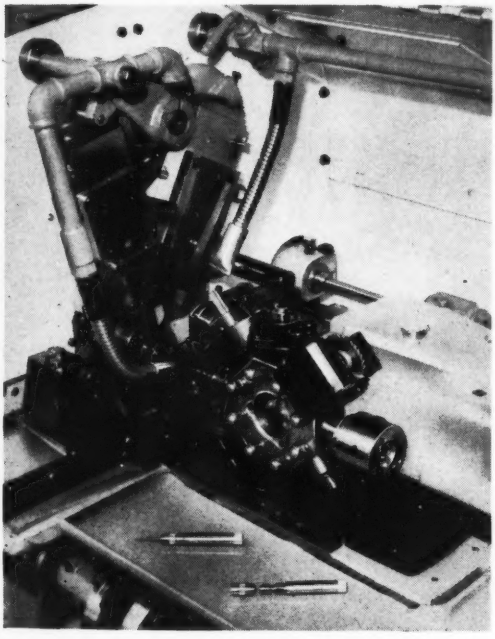
MATERIAL: BSS 240
SCALE: 5:1

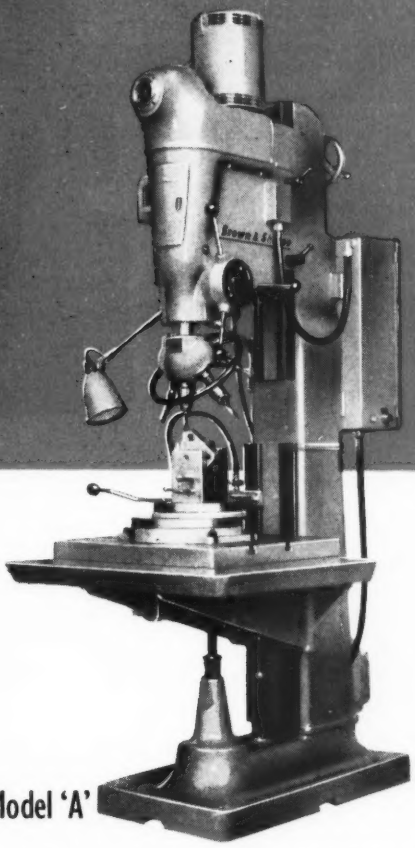
Brown & Sharpe at Brussels

STAND No. 2105 HALL 2

See the latest model of the
2G ¾" Capacity AUTOMATIC
with a maximum spindle speed of
5080 r.p.m.

EQUIPPED WITH 3rd & 4th SLIDE, BRAKE IN - NEUTRAL 8 HOLE TURRET AND TURRET MILLING ATTACHMENT





Model 'A'

TURRET DRILLING MACHINE

With six precision-indexing spindles on a single axis, the BROWN & SHARPE turret drilling machine will give production increases of up to 500% over conventional machines. Special work-positioning table cuts the need for expensive jigs and fixtures too. Only working spindle revolves and stops control depth within 0.002in. Drill capacity is up to ¼in. diameter. Spindle speeds infinitely variable between 200 and 4000 r.p.m. *Write for complete details.*

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Brown & Sharpe Limited

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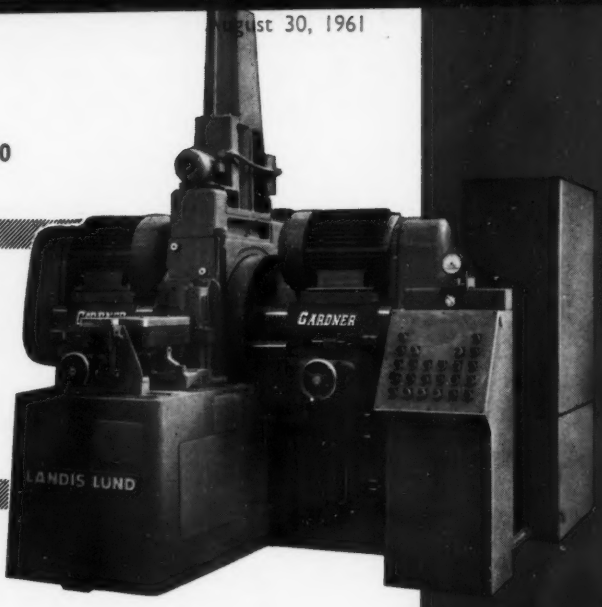
B·S

LANDIS LUND GARDNER 2H30-30
Double Spindle Disc Grinder

Grinds two parallel surfaces in one operation.
Applications are wide and varied.
26" or 30" diameter discs up to 3" thick.
Drive motors of 20 h.p., 25 h.p., or 30 h.p.
Machine exhibited is grinding parallel and flat, side faces of ball bearing outer races.



LANDIS LUND

LANDIS LUND 'PRECIMAX'
type FB.2 Fine Boring Machine

This Double Ended "Precimax" Fine Boring Machine on show at Brussels is carrying out fine boring, facing and chamfering operations to Automobile Differential Cases.
Precision built with electrical control and hydraulic operation, fine finish and accuracy at high production rates is ensured.
Tooled to individual requirements including auto cycle sequences.

LANDIS 5″ x 40″ type DH
Cam Contour Grinding Machine

Of advanced and proved design, available with 26″, 30″ or 40″ cradles. Stock removal up to 0.200″ Tapered cams in one direction or both can be ground on a production basis. Machine has automatic grinding cycle. Machine exhibited is grinding cam contours of a four cylinder Automobile Camshaft.

P at Brussels

HALL 7, STAND No. 7206
7th EUROPEAN MACHINE TOOL EXHIBITION · BRUSSELS · 1961

LANDIS LUND 16″ x 42″ type DH
Hydraulic Crankpin Grinder

Will be demonstrated grinding the pin diameters of a six cylinder Automobile Crankshaft. Features of this machine are: hydraulically operated wheel profile dressing attachment, automatic size control together with **MICROFEED** ensuring uniform production and automatic elimination of all grinding feed variables. This type of machine is available in two different swings and three different lengths.

LANDIS LUND LIMITED

CROSSHILLS–KEIGHLEY–YORKSHIRE

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CINCINNATI MILLING MACHINES LTD., BIRMINGHAM, ENGLAND

CINCINNATI

+GF+

7th European Machine Tool Exhibition, Brussels 3rd-12th September, 1961
This machine will be shown.

Automatic +GF+ New Britain Copying Lathe KDM-18 R with tube feed

George Fischer Limited, Schaffhausen, Switzerland

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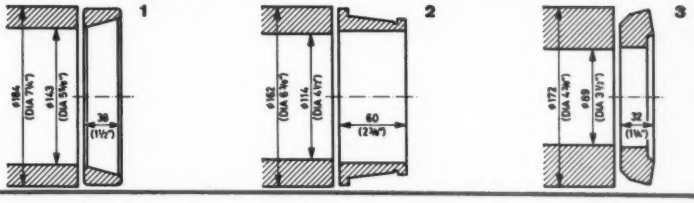
1. Outer race for taper-roller bearing
   Cycle time: 1.43 min
2. Inner race for taper-roller bearing
   Cycle time: 1.37 min
3. Crown wheel
   Cycle time: 1.80 min



With +GF+ copyturning from tube, production costs can be reduced by as much as one-third:

Less material allowance
Loading of a whole tube instead of a single workpiece
Automatic tube feed
Automatic unloading
Faster machining cycles

Special models can be built. Please enquire.

DRUMMOND-ASQUITH *Machine*

We invite you to inspect the Machine Tools which will be exhibited on the Stands listed on these pages.

SNOW & CO. LTD., Sheffield, England. **STAND 7502, HALL 7**

SURFACE GRINDING MACHINES

A 20 inch Double Disc Grinding Machine will be exhibited and it incorporates Hopper Loading, Automatic Sizing and Automatic Ejection Equipment.

BOHLE ..... **Germany**
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STAND 9210 ..... **HALL 9**

DEUTSCHLAND ..... **Germany**
WHEEL TURNING LATHES
STAND 5009 ..... **HALL 5**

GEHRING ..... **Germany**
HONING MACHINES
STAND 7504 ..... **HALL 7**

H.E.B. ..... **France**
CENTRE LATHES & COPYING LATHES
STAND 4123 ..... **HALL 4**

JUNGENTHAL ..... **Germany**
VERTICAL TURNING & BORING MILLS
STAND 5303 ..... **HALL 5**

KRAUSE ..... **Austria**
FINE BORING MACHINES
STAND 6014 ..... **HALL 6**

LIDKOPING ..... **Sweden**
CENTRELESS GRINDING MACHINES
STAND 7703 ..... **HALL 7**

MANURHIN ..... **France**
SINGLE SPINDLE AUTOMATICS
STAND 2001 ..... **HALL 2**

M.S.O. ..... **Germany**
GRINDING MACHINES
STAND 7600 ..... **HALL 7**

NASSOVIA ..... **Germany**
DIE SINKING MACHINES
ROTARY TABLE CHUCKING AUTOMATICS
STAND 6214 ..... **HALL 6**

PETEWE ..... **Germany**
PROJECTION FORM GRINDING MACHINES
STAND 7701 ..... **HALL 7**

U.V.A. ..... **Sweden**
INTERNAL GRINDING MACHINES
STAND 7603 ..... **HALL 7**

WALDRICH COBURG .... **Germany**
PLANING & PLANO MILLING MACHINES
STAND 5105 ..... **HALL 5**

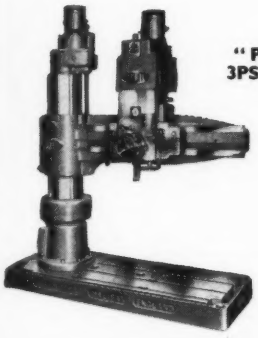
. . . If you cannot visit Brussels and would like more details, write for a catalogue and mention the type of machine which interests you.

Tools at BRUSSELS Sept 3rd-12th

ASQUITH MACHINE TOOL CORPORATION LTD., HALL 5 STAND 5101

6′ 0″ Radius
3PS Radial Drilling Machine

Of up-to-date design with compact grouping of controls and special form of spindle mounting for maximum rigidity when drilling or boring. 12 speeds and 6 feeds are standard. Drilling capacity from the solid in steel, 3″ continuously, 3½″ occasionally.



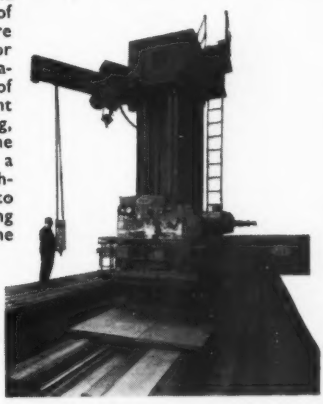
" Preselector " 8′ 0″ Radius
3PS Radial Drilling Machine

This machine is equipped with Pre-selection of feeds and speeds giving silent, foolproof gear change which can be pre-selected whether the spindle is running or not. The change is effected when the spindle is running, by operation of a push button.

6″ Spindle Ram Type
Horizontal Milling & Boring Machine

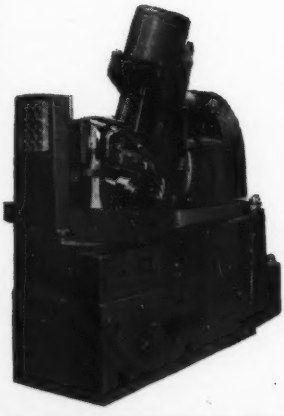
The Asquith Ram Type machine is designed for exceptional versatility of operation on large workpieces at one setting of the component. The robust proportions of the machine ensure adequate rigidity for heavy milling operations. A wide range of attachments for right angle milling, boring, etc., can be fitted at the front of the ram and a surfacing slide attachment when bolted to the flange of the milling sleeve has all the features of a built-in facing head.

The Asquith Ram Type is built in a range with spindle diameter up to 11 in.



DRUMMOND *HOBlique*

Gear Hobbing Machine with Automatic Loading and Unloading



The 12″ HOBlique machine is being demonstrated set up for the completely automatic cutting of one of the gears on a tractor layshaft cluster gear. It is equipped with swinging arm loading mechanism and operates on a fully automatic cycle.

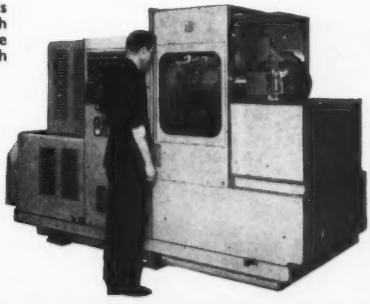
This compactly designed machine has a vertical work axis and the hob slide moves through the oblique plane when cutting helical gears. It is an ideal machine for high speed, heavy feed, mass production of transmission gears.

WARNER SWASEY ASQUITH 2AC

Single Spindle Chucking Automatic

The 2AC is an accurate high-production machine with quick set-up features that make it economical for operation on a variety of work required in medium quantities. Two cross slides feed tools at 90° to the spindle axis and a 5 station main slide operates parallel to the spindle. These slides can operate in various combinations with each other. The 2AC is fitted with a 12 in. chuck.

British Built



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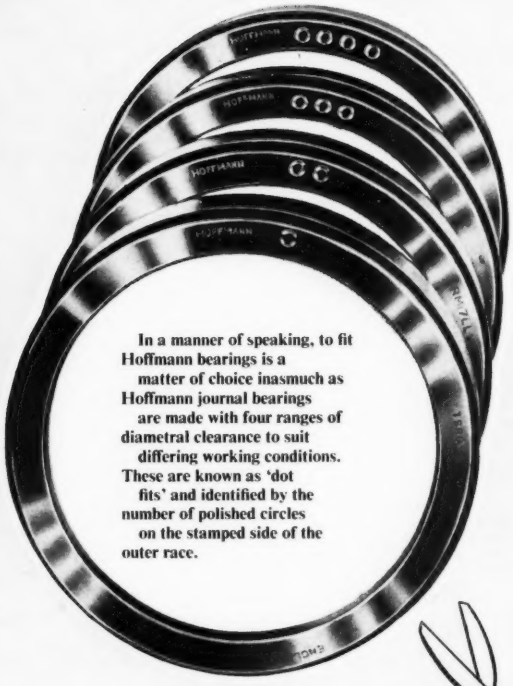

In a manner of speaking, to fit Hoffmann bearings is a matter of choice inasmuch as Hoffmann journal bearings are made with four ranges of diametral clearance to suit differing working conditions. These are known as 'dot fits' and identified by the number of polished circles on the stamped side of the outer race.

a fitting choice...

'O'—These bearings have the smallest amount of diametral clearance for use where freedom from all shake is required in the assembled bearing, and are only supplied upon our specific recommendation.

'OO'—These bearings have a grade of diametral clearance intended for use where only one race is made an interference fit and there is no appreciable loss of clearance due to temperature differences.

'OOO'—For use when both races of a bearing are made an interference fit, or when only one race is an interference fit and there is loss of clearance due to temperature differences.

'OOOO'—These bearings are used where there will be some loss of clearance due to temperature differences and both races must be an interference fit. It is recommended however, that customers should always consult us before ordering bearings of this fit.

HOFFMANN
ball and roller BEARINGS

HOFFMANN

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BRANCHES AND STOCKROOMS IN ALL PRINCIPAL TOWNS

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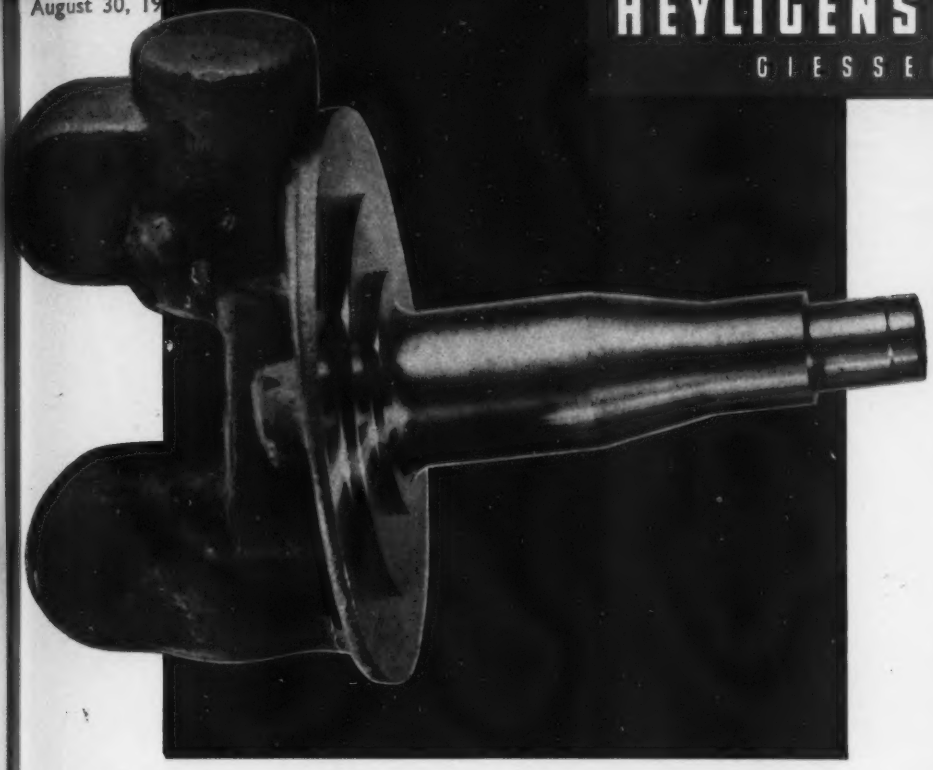

AUTOMOTIVE STEERING KNUCKLE, COPY-TURNED ON A HEYCOMAT 2

is a representative example of the economical HEYLIGENSTAEDT Copy-Turning. The workpiece is machined all over in one pass, although it has several shoulders, tapers, radii and fits. The diameters varying from 1·20″ to 8·90″ are turned by means of a built-in gearing which can be controlled under load, with nearly constant cutting speed. The feed is automatically and infinitely variable.

After loading the workpiece, the operator just pushes the START button; all the rest is accomplished by the automatic system of the machine.

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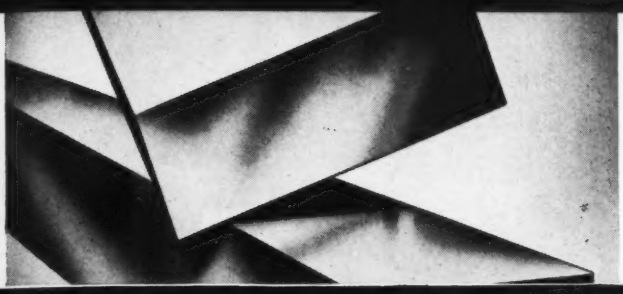

Coghlan

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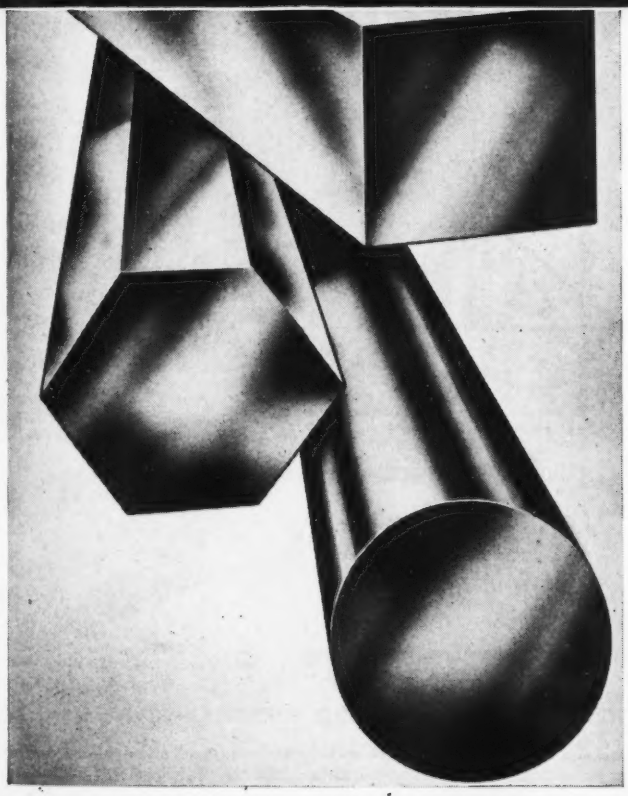

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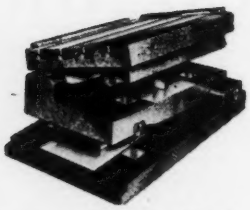
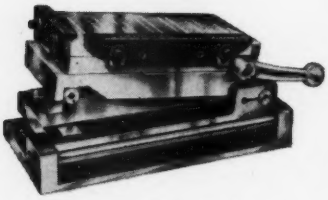
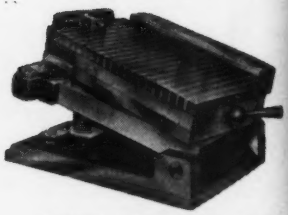


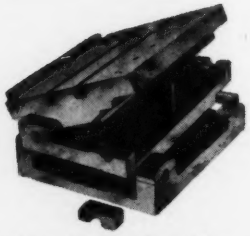
Compound Sine Table with 'T' Slotted Face: 12in. by 8in.



Compound Sine Table with Non-Electric Magnetic Face: 10in. by 5in.



Produced for Grinding Turbine Blades. Tilting and Swivelling with 14in. by 8in. Non-Electric Magnetic Chuck.



Special for Aircraft Industry. 'Completely Universal: 12in. by 10in.

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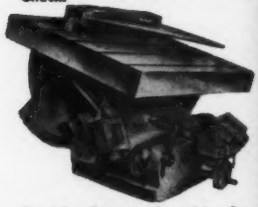
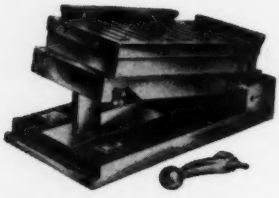
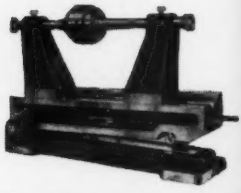


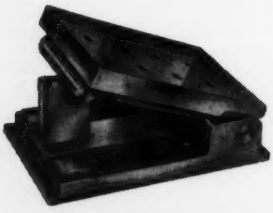
Special Compound with Super Accurate Scales and Optical Projection Micrometers.



Simple Angle Sine Table with Non-Electric Magnetic Face: 10in. by 5in.



Sine Centres, with or without extended base, surfaced parallel to the centre axis when at rest.

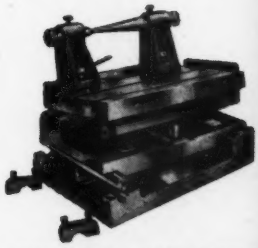


Simple Angle Sine Table with Tapped Holes for Clamping: 6in. by 4in.

CROWN

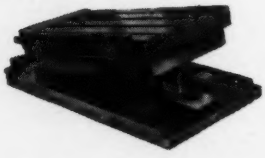
RANGE

Centres for most standard types can be supplied at extra cost.



Universal Compound Sine Table with 'T' Slotted Face: 11in. by 7in.

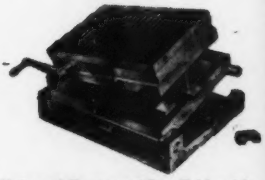
Manufactured in England by



Simple Angle Sine Table with 'T' Slotted Face: 12in. by 8in.

WINDLEY BROS LIMITED

Write for fully illustrated brochure and prices of these and other Crown products



Universal Compound Sine Table with Non-Electric Magnetic Chuck: 12in. by 8in.

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7th European Machine Tool Exhibition

BRUSSELS 3rd-12th September

A cordial invitation is extended by some of the foremost machine tool companies* to visit their stands.

An inspection of the machines on these stands will reveal the latest trends in machine tool design and construction, from conventional centre lathes to the most modern copying machines, from gear manufacture and inspection to the most recent developments in unit-head machines.

Sykes Machine Tool engineers will be in attendance throughout the exhibition.

*Write for a description of all exhibits.

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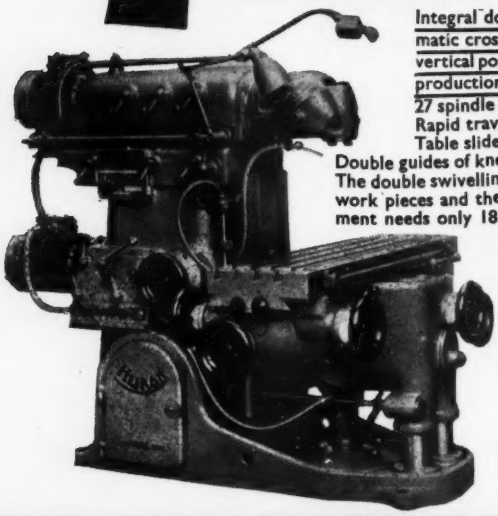
SLIDING RAM GIVES 27½in. AUTO CROSS FEED

HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS



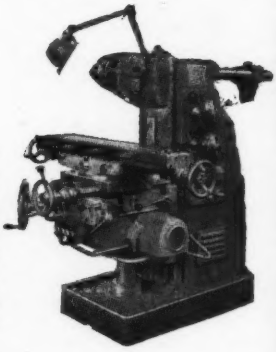
Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Heads can be retracted completely from line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from ¼in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in. automatic cross movement needs only 18in. clearance. OPTIONAL EXTRA FEATURES: Mounted spacing casting assemblies providing additional 8in. capacity under spindle. 26in. wide 8 T-slot tables and 39½in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56½in. × 15½in.	43½in.	27½in.	19½in.
KU5	64½in. × 15½in.	51½in.	27½in.	19½in.
KU6	78½in. × 16½in.	59in.	27½in.	19½in.
KU55	64½in. × 26in.	51½in.	38½in.	18⅞in.
L83	157in. × 59in.	118in.	39½in.	59in.

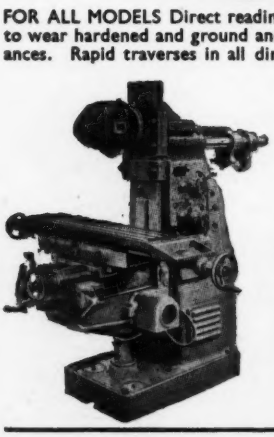
Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

DUFOUR UNIVERSAL MILLERS

WITH DOUBLE UNIVERSAL SWIVELLING HEAD, RETRACTABLE SLIDE BRACKET AND SPACING CASTING GIVING 26" DAYLIGHT ON No. 59 AND 21" ON No. 61



FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m. Double swivelling universal head on retractable slide bracket providing with 5½in. Spacing Casting Drive assembly on 59 Machine 26in. daylight, and 21in. on No. 61.



MODELS 53 & 61. 16 universal head spindle speeds. 21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r.p.m.; 8 automatic feeds ½-18½in

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 21-1180 r.p.m.; 16 automatic feeds ½-20in.

MODEL 54. Automatic cross feed of universal head 20in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds ⅛-23½in.

Type	Table	Automatic Feeds Long.	Cross	Vert.
53	43½in. × 9½in.	27½in.	9½in.	15½in.
61	47½in. × 10½in.	30½in.	9½in.	15½in.
59	51⅛in. × 11½in.	34⅝in.	11⅛in.	21⅛in.
54	67in. × 14½in.	43½in.	14½in.	20½in.

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SEPTEMBER 3—12, 1961

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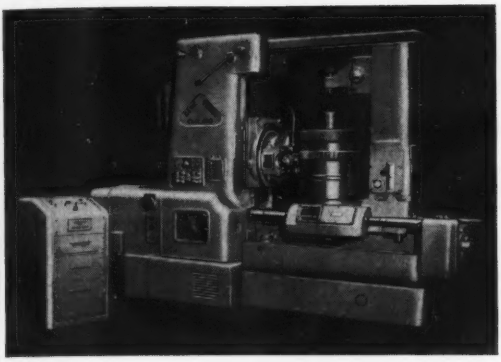
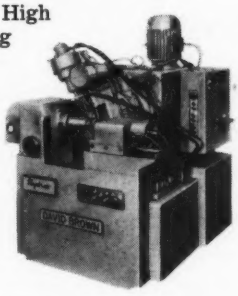
David Brown precision machine tools for gear production



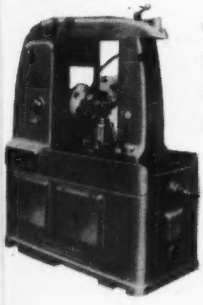
The UPH.30 Ultra Precision Hobbing Machine produces gears up to 30 in. dia. It incorporates electronic accuracy control, measuring accuracy at 30 in. diameter being 0.00015 in.

The design of David Brown precision gear cutting and finishing machines in based on the experience of over 100 years. The range is the widest offered by any one company, and covers all types of production techniques for spur and helical gears up to a size of 18 ft. diameter. The four machines shown are typical of the whole range, in that within their fields, they combine a high degree of accuracy with high production rates. David Brown machines like these are giving fine service in nearly every country of the world.

The No. 10 Hydrax High Production Gear Hobbing Machine has a capacity of 10 in. dia. Capable of the fastest known production rates, it is used extensively by the automobile and tractor industries. Complementary Production Gear Shaving Machines are produced.



The range of Turbine Gear Hobbing Machines has capacities up to 18 ft. dia. Of special interest to producers of marine gears where a very high degree of accuracy is essential. This range can also incorporate electronic accuracy control. A similar range of turbine gear hobbing and shaving machines is manufactured.



The MT.15 is one of the MT series machines which cut a wide variety of spur and helical gears, splines and sprockets, from 1 in. to 8 ft. 4 in. dia. They can also produce wormwheels by the tangential feed method.

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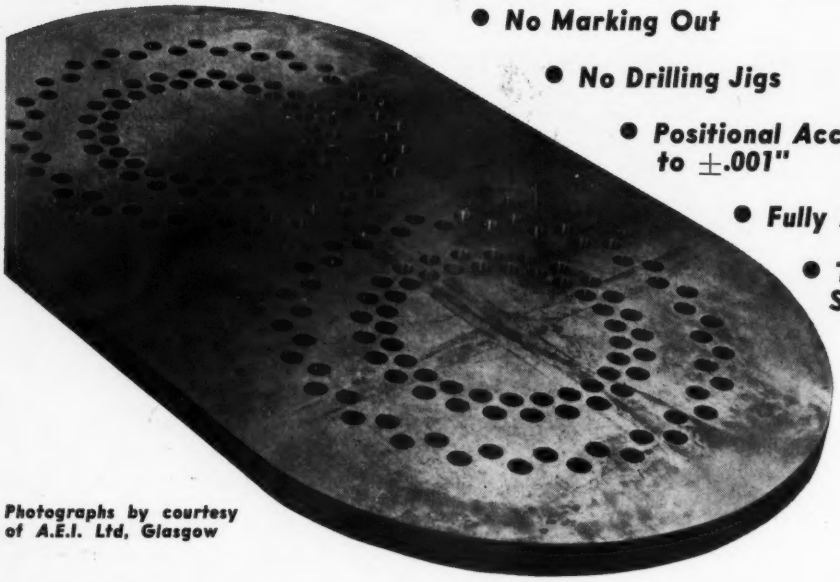

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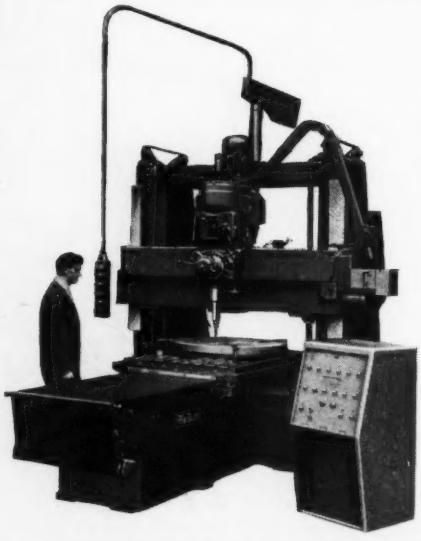
- *Tape or Dial Setting*

Photographs by courtesy of A.E.I. Ltd, Glasgow



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This machine will accurately position holes up to 2in. diameter in steel. It eliminates all marking off as well as the necessity of using drilling fixtures. Once the tape has been punched—a relatively simple operation — exact repetitions of even the most complicated drilling jobs are guaranteed at any time. The rigidity of the machine enables maximum diameter drills to be fed directly into steel without the break-through problem normally experienced. The price of this machine, complete with positioning control system, compares favourably with a conventional drilling machine of the same capacity. Either single or multi-station turret heads can be fitted. May we send you more details?

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Model HYB.50.GVU Electric-hydraulic Automatic Tube Cold Bending Machine for tubes up to 50mm. o.d. with 2mm. wall thickness = approx. 2″ o.d. with ·08″ wall thickness. *i.e.* the Automatic Tube Cold Bending Machine fitted with: fully automatic combined positioning and angular turning-device, but *without* feeding device.

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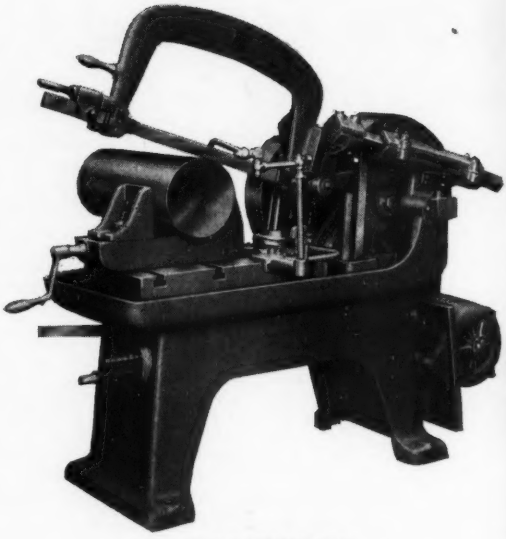

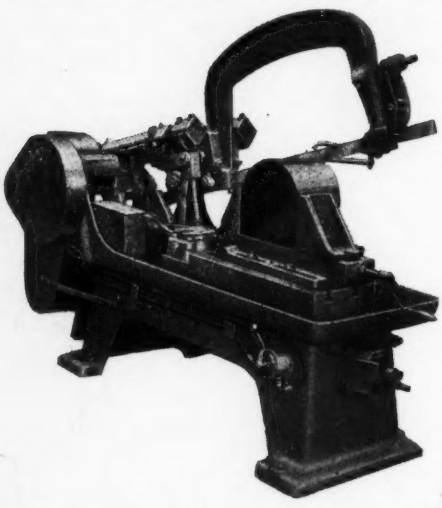

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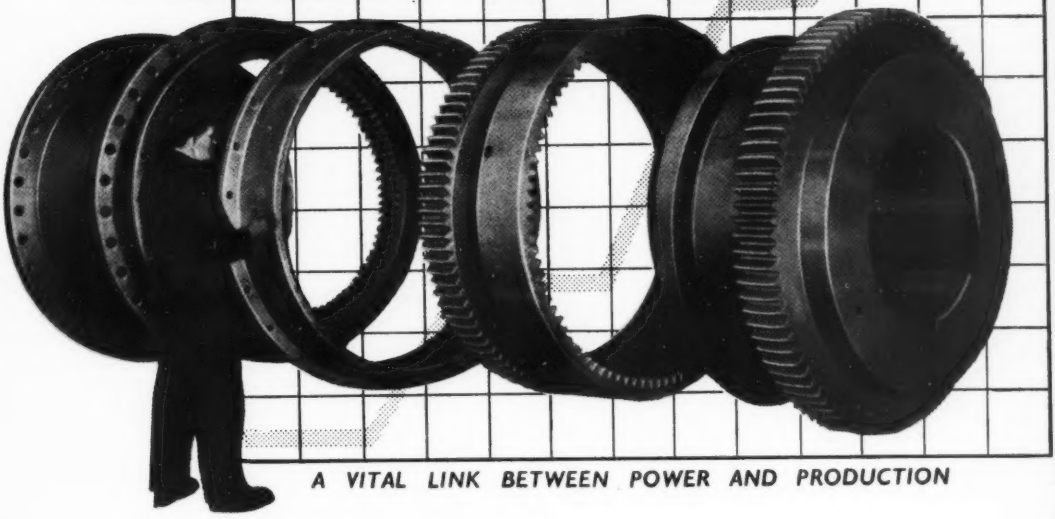

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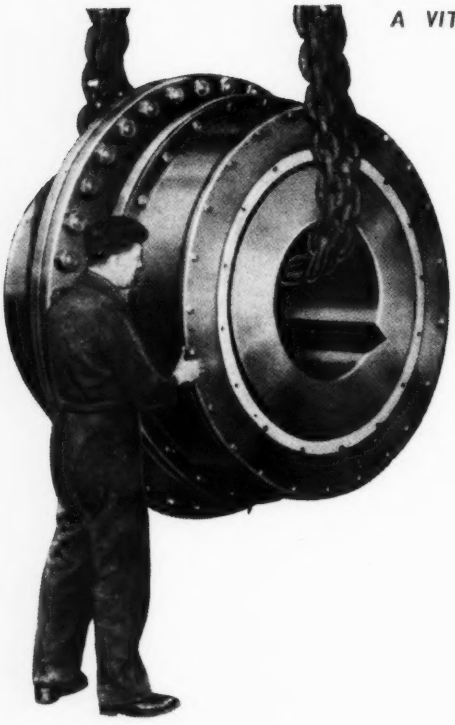

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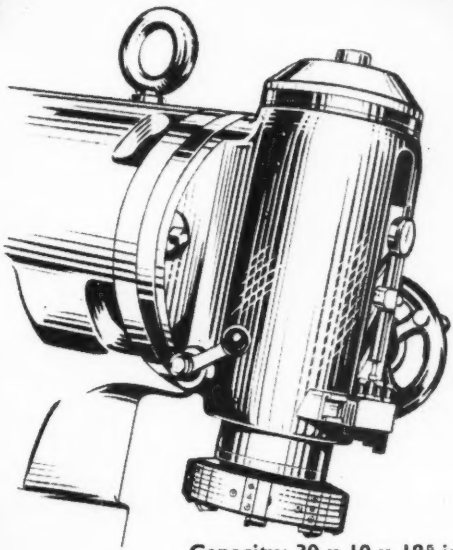

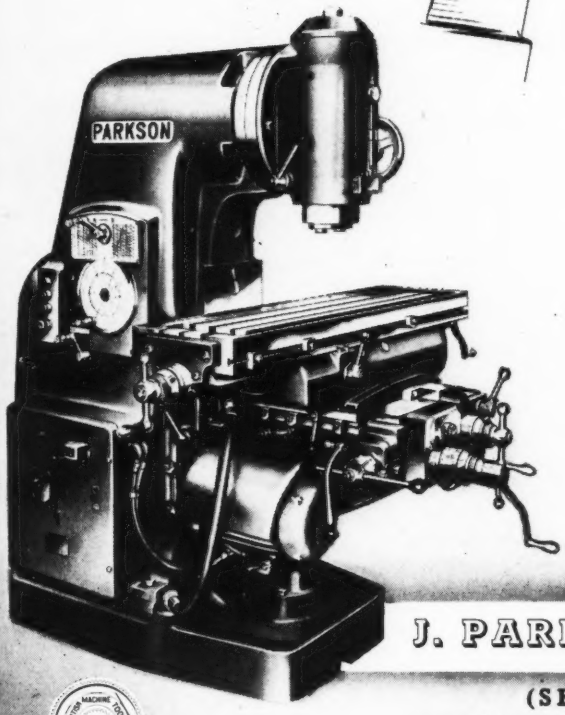

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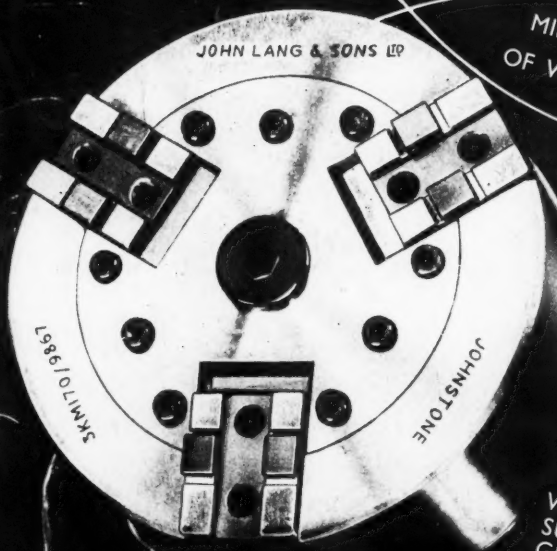

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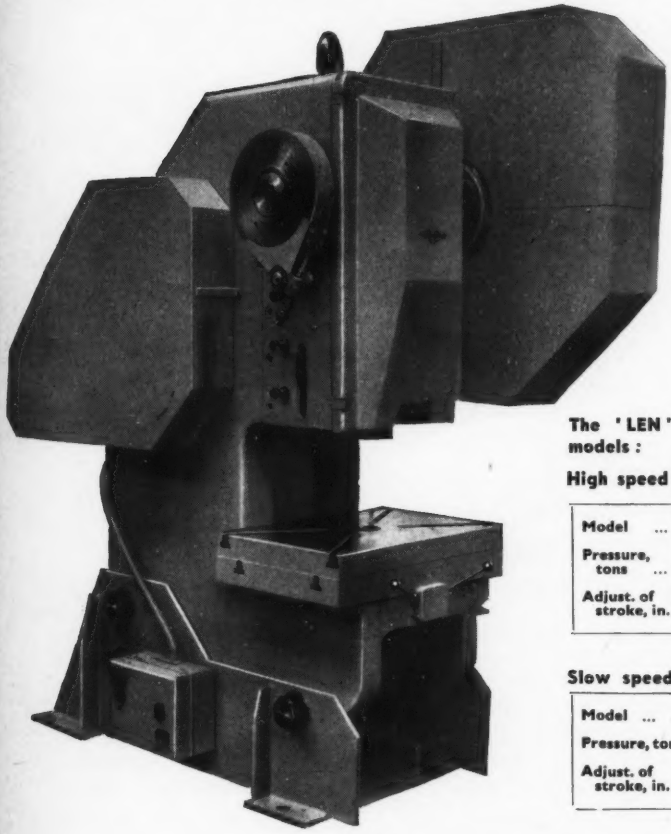

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Model	25/220	40/250	63/280*	80/315*	100/320
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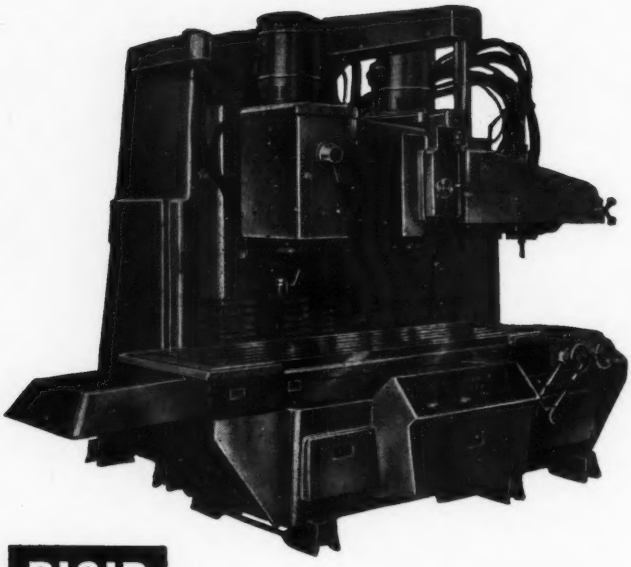

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AUTOMATIC HYDROCOPYING DIE SINKER MODEL KAB 250

Fully automatic — roughing and finishing — this exceedingly robust bed-type machine copies 3-dimensional dies, without supervision, from wooden or plaster models. Both left- and right-hand halves of the die can be copied at the same time from the same master. 360° profiling can be performed at constant feed, without rotating circular tables, *and* on vertical contours. Servo hand control permits speedy roughing. The machine has two spindles; single- and 4-spindle machines are available also.

Table size 130" × 25½". Spindle speeds (18) 42 to 2000 r.p.m. Copying feeds, steplessly variable ·4" to 15·75". Pick feeds ·006" to ·2".

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For PRODUCTION Jig Boring

SWISS **OERLIKON**

PRODUCTION JIG BORER MODEL R 2

With bridged double columns for extra rigidity this heavy duty machine combines rapid production with high precision. Positioning is automatic by easily stored punched cards or tape. Co-ordinate settings can be made by dials also. The quill head locks electrically. The outer column moves through an arc for loading heavy work and the long backward traverse permits it to be mounted low down on the front face of the table, providing extra working height. Many special tools are available for turning, milling, facing, tapping.

Drilling capacity 2 1/16" in c.i. Spindle speeds (18) 38 to 1900 r.p.m. Table traverse 42½".

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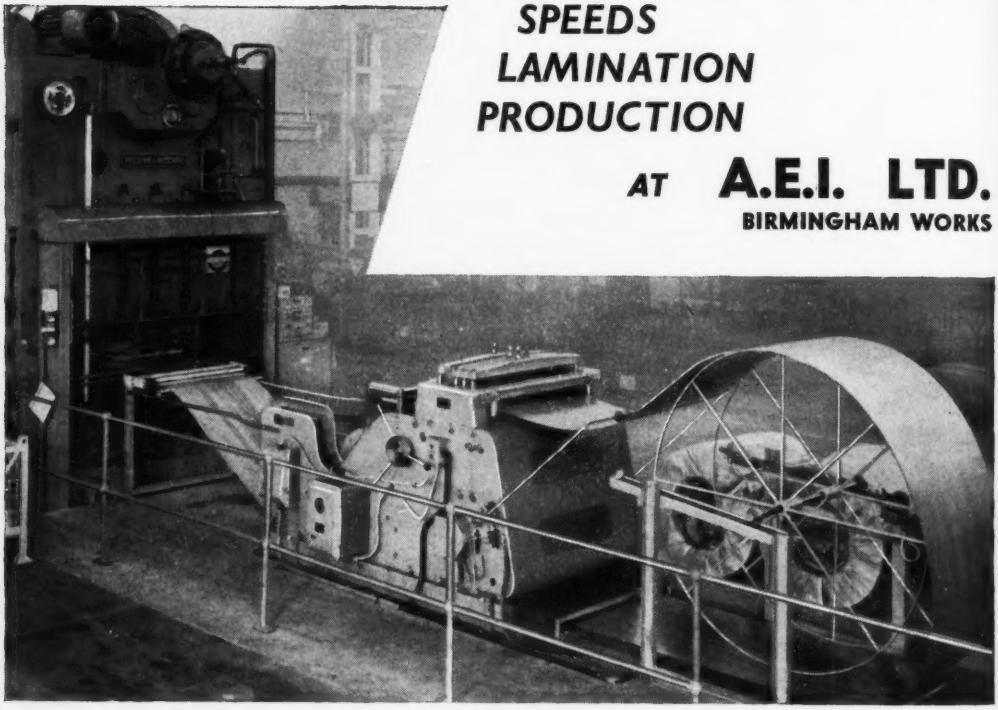

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BIRMINGHAM WORKS

Motorised and entirely self-contained, these machines will efficiently straighten and feed thick and thin stock at a variable speed to suit any requirements. Quick setting facilities to enable presses to be used to maximum capacity. In standard sizes with capacity from 6" to 33" wide by 1/8" thick.

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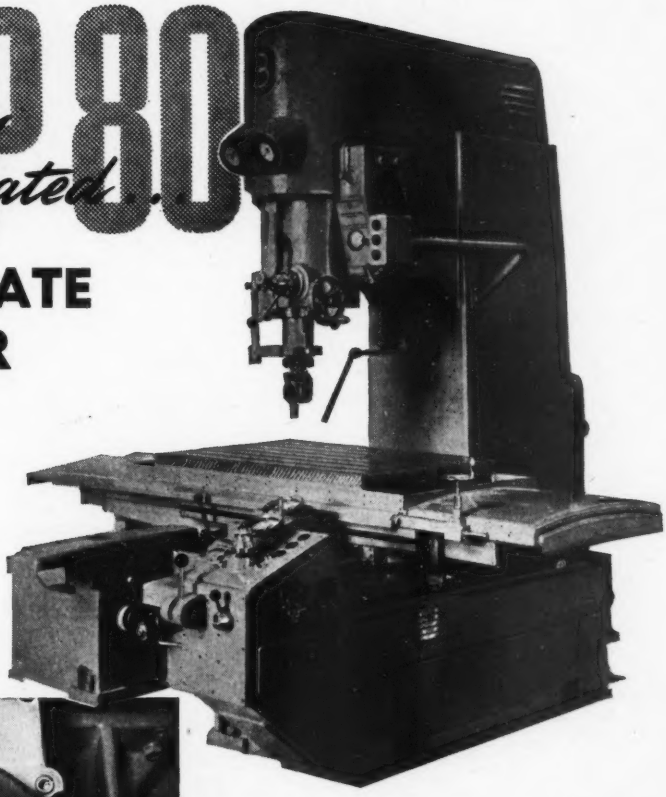
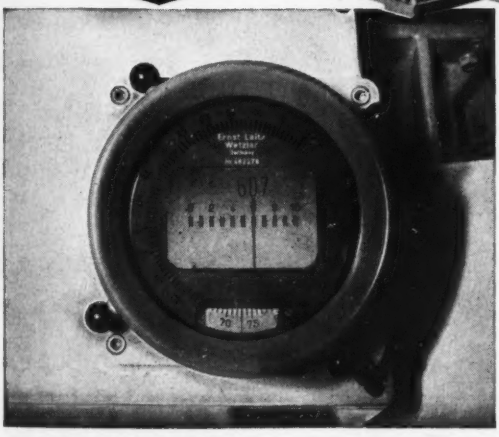
CO-ORDINATE JIG BORER

with OPTICAL MEASURING





ALSO AVAILABLE

Model 120 having table traverses — longitudinal 45" — transverse 25"

- ★ **Adjustment accuracy 0.00005"**
- ★ **Table hydraulically operated**
- ★ **Infinitely variable hydraulic feed to boring head**
- ★ **Table 48" x 30"**
- ★ **Spindle feeds infinitely variable 5-1500 r.p.m.**
- ★ **Table traverses — longitudinal 31½" — transverse 25"**

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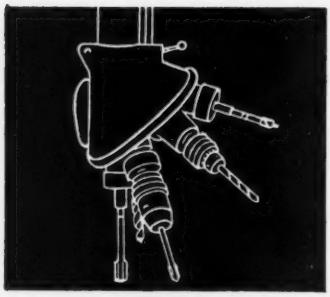
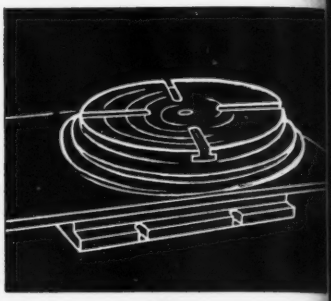


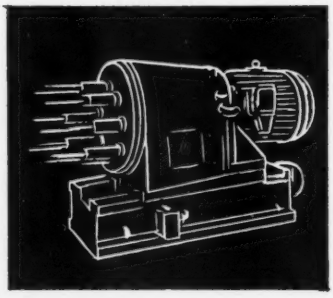
MULTIDRILL AND TAPPING HEADS

with fixed or adjustable spindle centres, for mounting on drilling machines or as self-contained units, with or without automatic feed cycle. Tapping with or without lead screw control.



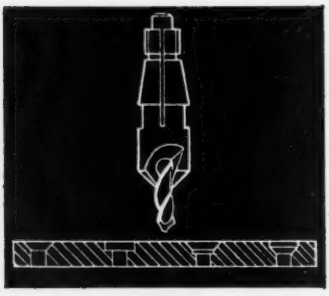
ARBO AUTOMATIC TURRET DRILL HEAD

2-7 stations, choice of 10 speeds and separate depth stop for each station. Tapping by reversing spindles and positive or friction drive. Automatic indexing, ⅜in. or 1in. drilling capacity.



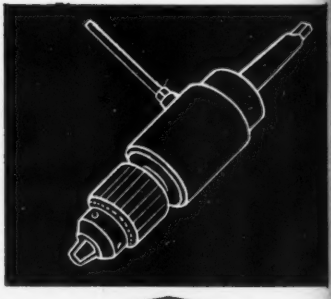
THOKA FLOATING COMPOUND TABLE

saves handling time and jig cost. Floats on air for fingertip positioning, locked by air pressure during drilling. 12in. and 18in. table diameters. Arranged for indexing, can be set quickly to any P.C.D.



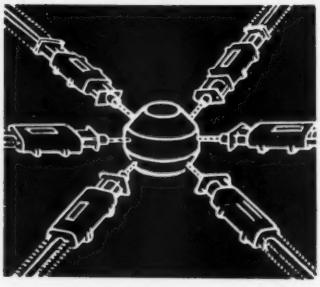
COMMANDER MULTI-ANGLE DRILL UNITS

low priced compact units for special set-ups for drilling at odd angles, re-set rapidly for another job. Flexible shaft drive, self-contained, hydraulic or pneumatic feed system. ⅜in. dia. capacity, 4in. stroke.



PROCEDO COMBINATION COUNTERSINKERS

do two operations in the time of one. Combined drilling and countersinking, counterboring deburring or trepanning, with ordinary twist drills.



COMMANDER DRILL CHIP BREAKER

drills deeper and more accurate holes at higher speeds, by breaking the chips into small fragments. Fewer broken drills and more holes between re-grinds. ½in. maximum drill size.

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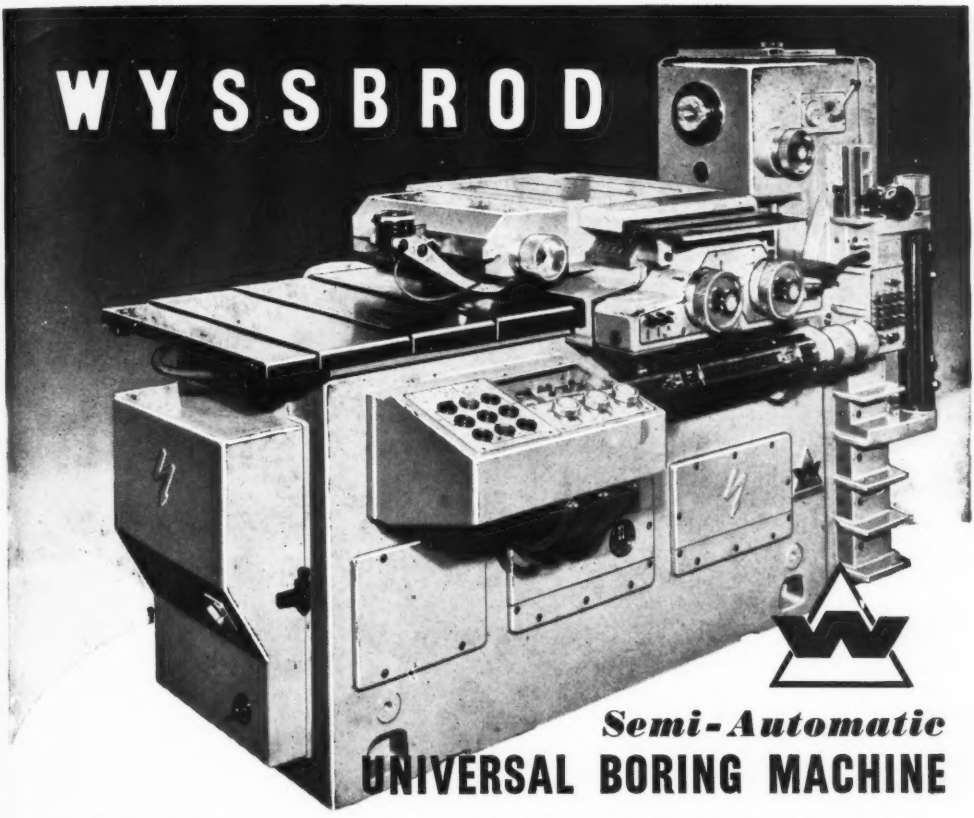

Semi-Automatic
UNIVERSAL BORING MACHINE

Single or series production ■

Repetitive co-ordinate positioning ■

Automatic clamping and unclamping of the slides ■

Electro-hydraulic control ■

Optical readings to 0.0004″ ■

Light precision milling if required ■

Rotary table 16″ x 16″ optional ■

Brief specification :-	Model B57
Dimensions of table	26″ x 20″
Longitudinal stroke	20″
Transverse stroke	12″
Vertical stroke	12″
Feeds (stepless) ins/min.	2–11¼
Spindle speeds, r.p.m. (16 steps)	48–4000

This hydraulically-operated machine, built by an old-established Swiss company to traditional Swiss standards of precision, is an economical production jig borer suitable for "one-off" or series production, without the need for costly jigs and fixtures.

Its system of repeat co-ordinate setting, allied to robust construction, ensures consistent positional accuracy to 0.0004″. The table and headstock clamp and unclamp automatically, but can be released for milling operations, and the spindle speeds can be changed automatically if required.

Outstanding features are hydraulic power to the table and headstock ; stepless feeds ; wide range of spindle speeds ; manual fine adjustment ; optical scales, and centralised controls.

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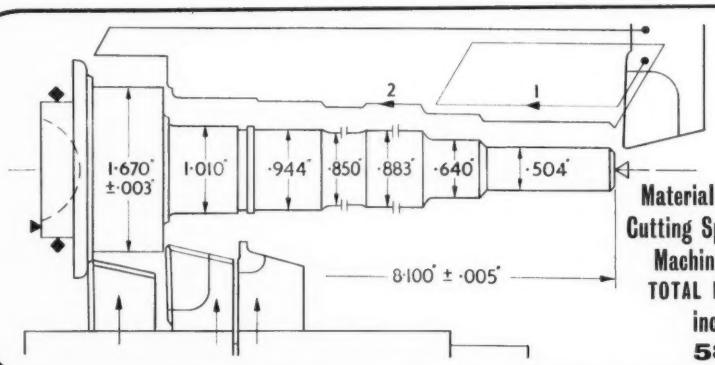
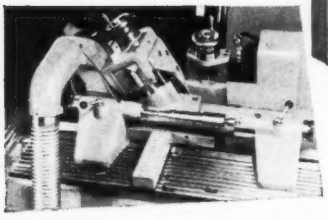


Typical Demonstration

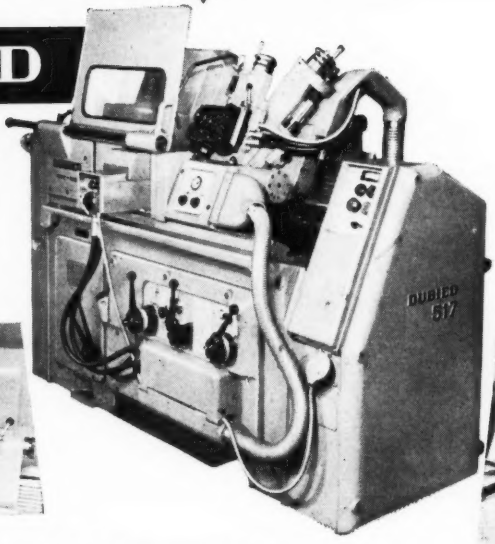
Material—EN 18c Forging
Cutting Speed—850 f.p.m.
Machine Time—50 secs.
TOTAL PRODUCTION TIME including loading 58 Seconds

DUBIED

HYDRAULIC COPYING LATHE 517

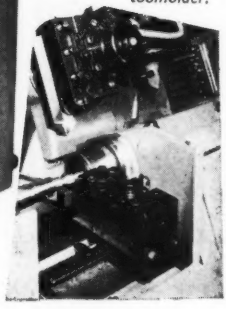


Automatic feed-change trips.



This Swiss-built automatic copying lathe is of unit construction and available in several forms according to need.

Auxillary plunge cut toolholder.



The 517 r 6 illustrated incorporates automatic change of motor speed, automatic 6-cycle attachment, automatic feed change, hydraulic plunge cutting attachment, hydraulic clamping and tailstock operation, and automatic indexing toolholder to copying slide.

The tool path can be pre-set for a number of roughing cuts, after which the toolholder in the copying slide automatically indexes to bring the finishing tool into position for the full copying sequence, or for selected diameters, hydraulically controlled from the template follower.

The plunge cutting toolholder mounted on the front slide advances to produce shoulders and undercuts as required.
Work loading is facilitated by hydraulic clamping and tailstock operation, after which the machining cycle is entirely automatic.

Distance between centres	20 inches
Swing	9½ inches
Max. turning diameter	4¼ inches
Spindle speed	from 350 to 4,000 r.p.m.

A demonstration of this versatile machine will be gladly arranged on request.

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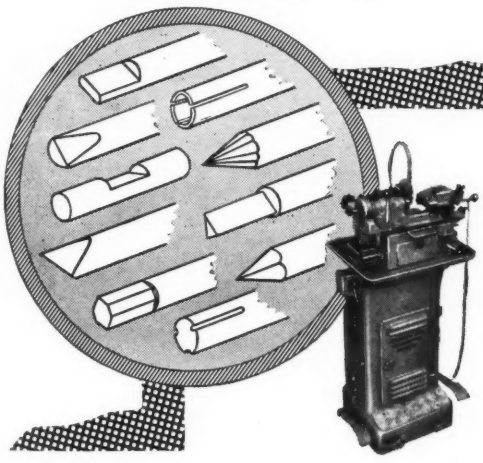
GYGI

Precision Turning and Screw Cutting Automatic

For simplicity of set-up with high output.

This Swiss high-precision sliding head automatic is suitable for the economic manufacture of turned and screwed parts in small or large quantities The standard cams cover the great majority of the machine's possible operations, so that change-overs are speeded up by eliminating cam-making. Thus the machine has the flexibility and easy set-up of the capstan combined with the high output of the automatic. 3, 4, or 5 tool slides are available, and the machine's versatility is further increased by interchangeable end-working attachments for slotting, drilling, undercutting, copying, tapping and threading, either right-or left-hand, up to the maximum bar capacity of the machine.

Brief specification :-		*GL 16/7*	*GL 16/10*
Maximum bar capacity,	round	17/64"	25/64"
	hexagon, A/F	15/64"	23/64"
	square, A/F	13/64"	17/64"
Maximum length turned ...		2"	2"
Maximum diameter threaded, M.S.		17/64"	17/64"
Spindle speeds, r.p.m. (16 steps)		2800–8200	2800–8200



Multiple Flat Milling or Grinding Machine

A semi-automatic multi-purpose machine for performing second-operation grinding or milling, in-feed, longitudinal and conical, on components up to $\frac{3}{8}$" diameter Rapid loading and unloading assures economical batch or series production.

Brief specification :-	*GL 17*
Maximum bore of collet ..	$\frac{3}{8}$"
Maximum diameter of work...	11/32"
Maximum length machined ..	$1\frac{1}{4}$"

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Telephone : Coventry 74321

523 F 18/61

Here at last . . . .
the Swiss-built precision grinding machine that industry has been waiting for.

MIPSA

Push-button Precision Grinding

Brief Specifications

	Type RUS 130 x 400	Type RUS 130 x 750
Height of centres	5½"	5½"
Max. between centres	18½"	29½"
Max. diameter admitted	9½"	9½"
Max. stroke of table	17"	30½"
Min. stroke of table	·04"	·04"
Swivel of upper table	14°	14°

Toolrooms and production shops looking for positive accuracy in the production of small components have it here with push-button simplicity.

Increments as small as a half of one-tenth of a " thou " (0.00005") can be applied by the pressure of a button. Servo-controlled hydraulic feed mechanisms automatically adjust the stop by means of a micro-corrector, entirely eliminating the old trial and error method of applying increments by handwheel.

The hydraulic system of table feed coupled with the special micrometer stop make it possible to accurately grind shoulders in relation to one another by the simple use of gauge blocks.

The machine itself is built to typically high Swiss standards and is fully universal in application. The wheelhead rotates through 360 degrees, an internal grinding wheel spindle is fitted, and a second wheel can be applied for the production of tapers. Plunge or traverse grinding can be operated with the same facility.

Catalogue on request

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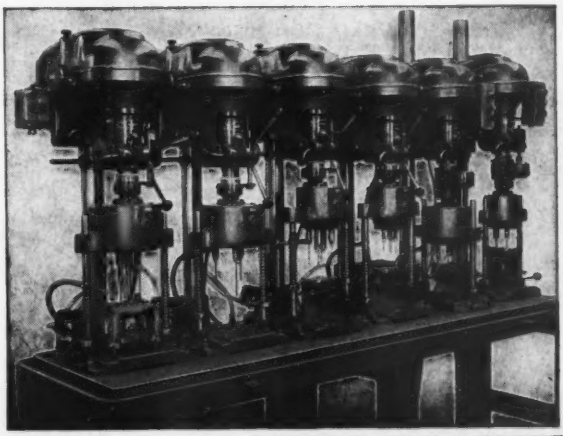
Have you investigated the possibility of using time-saving multi-spindle or multi-head methods on your components? We can supply anything from a simple 2-spindle attachment to a complete drill, ream, counterbore and tap sequence. Jigs and fixtures too, of course.



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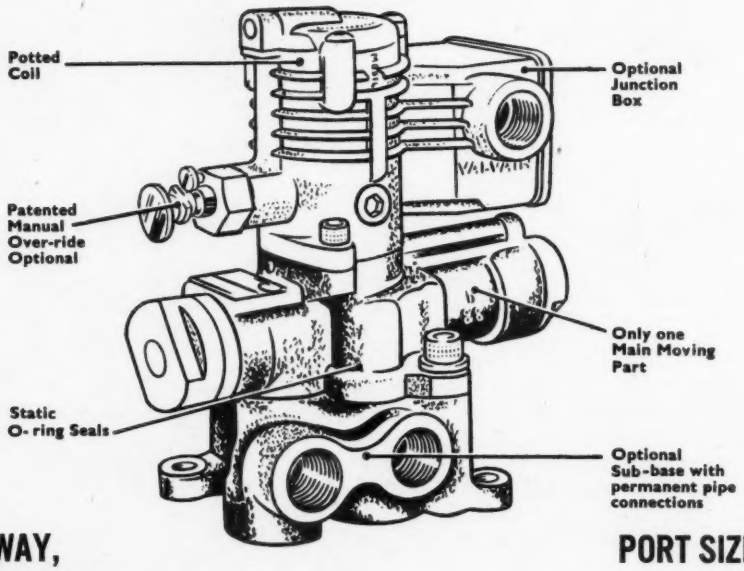

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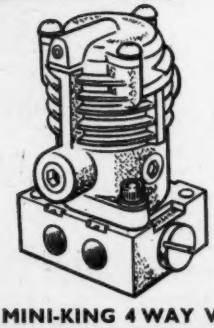
COILS GUARANTEED AGAINST BURN-OUT FOR VALVE LIFE



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- TIME DELAY
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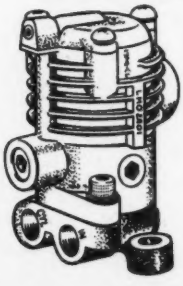
- DOUBLE SOLENOID
- MANIFOLDS
- PLUG-IN
- POWERED CENTRED NEUTRAL
- VACUUM
- 2-PRESSURE, 5-PORT
- MULTI-MILLION CYCLE LIFE
- COILS GUARANTEED AGAINST BURN-OUT FOR VALUE LIFE



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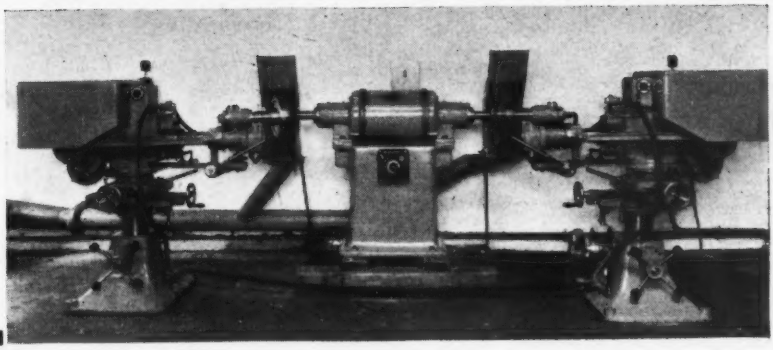

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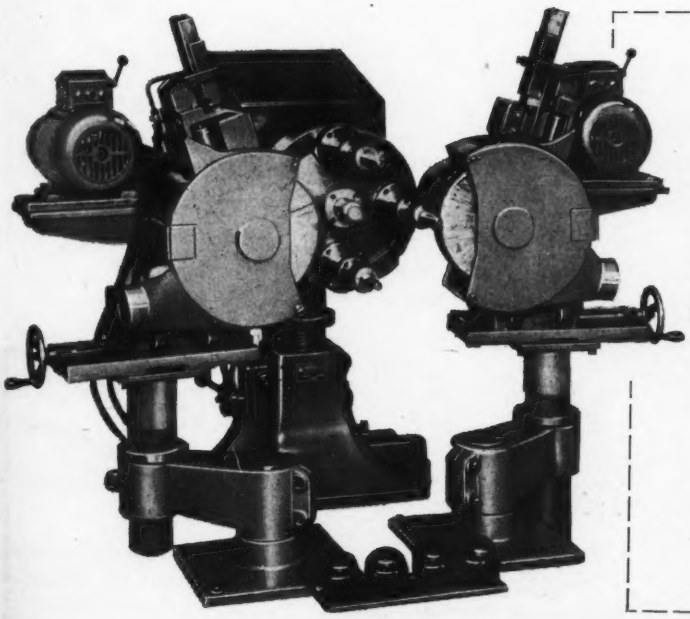

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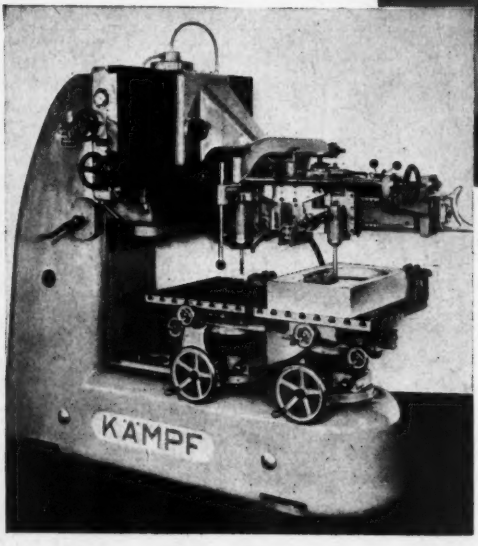
KAMPF
MODEL FK3
THREE-DIMENSIONAL
DIE SINKING MACHINE

. . . ensures true three-dimensional scanning. Working area 28" x 36". Maximum die block height 20". Maximum dead weight on table 1½ tons. Outside supports, however, enable much heavier and bulky jobs to be easily tackled.



* Profile milling radii into a die, size 43" x 33½" 14", weight 2½ tons. Material 70 ton tensile steel.

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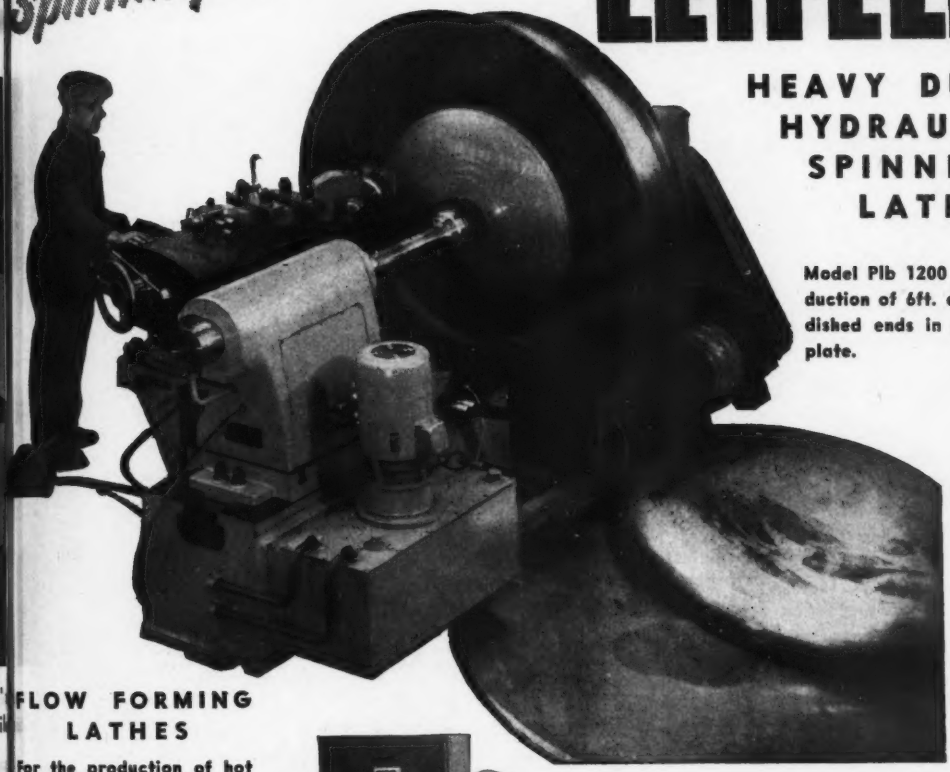

Model Plb 1200 on production of 6ft. diameter dished ends in ¾" steel plate.

FLOW FORMING LATHES

For the production of hot plate hollow-ware, stainless steel buckets, bowls, milk churns, jet engine parts, rocket and missile components, impellers, exhaust ducts, etc.

Model PJS 400 on production of concrete mixer drums.

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APEX

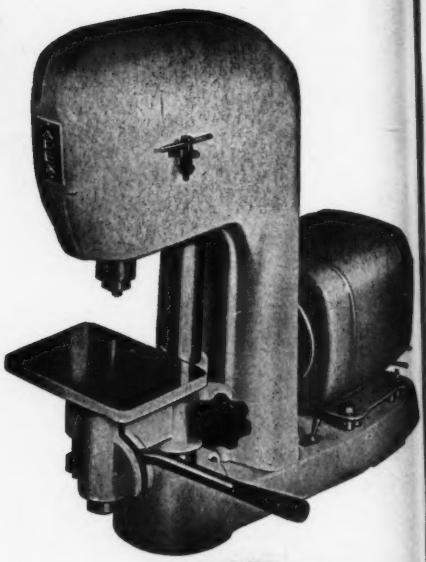
SENSITIVE TAPPING MACHINE

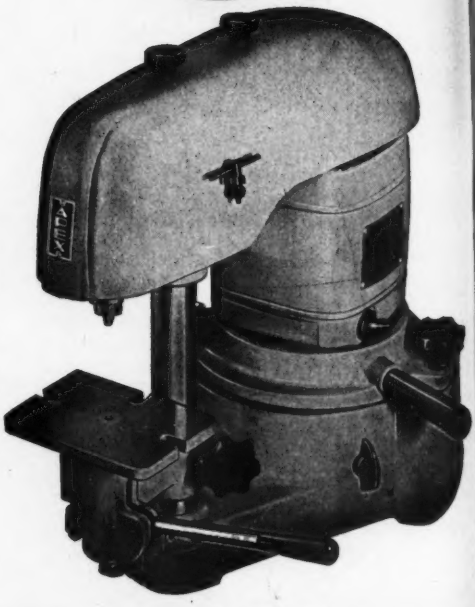
CAPACITY 14 B.A. to ¼in. Whit. in brass.
14 B.A. to 2 B.A. in steel.

The design of this machine is based on many years' experience of tapping small holes, combining speed of operation with maximum tap life. Simplicity and rigidity of construction ensure trouble-free working. The spindle is light, carrying no clutches or other mechanism and being rotated by a friction cone drive.

Both these machines have special quick-action table movement for fast production, plus robust construction. They are supplied complete with ¼ h.p. motor

Chuck Guards are now available for both machines





Junior **SENSITIVE DRILLING MACHINE**

¼in. CAPACITY SPEEDS UP TO 10,000 R.P.M.

This robustly constructed machine has been specially designed to produce accurate holes from 0.010in. to 0.250in. diameter, meeting the exacting requirements of the horological and instrument trades; it is equally suitable, however, for the general engineering workshop where accuracy and speed are the main considerations.

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We build a wide range of Rail Planers, which cover, either immediately or with simple adaptations, all rail planing requirements. Canting tables are available in a number of designs, and arrangements can be made to accommodate existing fixtures.

As an example of our latest and heaviest machines we show a photograph of a recently completed 4ft. 0in. machine on test in our works. The H.P. of the reversing motor is 100, and it will be clear from the illustration that the machine has been built with proportions such that this great power can be utilised to the full. We are always happy to discuss rail planing with our clients, with a view to the production of machines exactly suited to the work done at the depots concerned.

These Rail Planers follow the practice of our standard two - column and openside Planing Machines for normal machine shop duties. All the latest developments are incorporated, to permit maximum production, and we also have available a range of high speed Milling Heads, which are proving most successful in many difficult applications.

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GIDDINGS & LEWIS

Horizontal BORING, DRILLING & MILLING Machines

Now British Built

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Close tolerances required in Milling, Boring, Drilling and Tapping 'U.S.' MULTI-SLIDE Beds are maintained on Model 350-T machine at ALLTOOLS LTD., Brentford.

4" DIA. SPINDLE
(20 H.P. MOTOR)
OR 5" DIA. SPINDLE
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LONG LASTING JIG BORING ACCURACY

AMPLE POWER FOR HEAVY DUTY MILLING

WIDE CHOICE OF TABLE, BED AND COLUMN SIZES

WIDE RANGE OF SPEEDS AND FEEDS

UNEQUALLED MACHINING VERSATILITY

DIRECT READINGS TO 0·001" OF HEADSTOCK AND TABLE SETTINGS

BRIEF SPECIFICATIONS

Model	340-T	350-T
Diameter of spindle	4"	5"
Spindle motor	20 h.p.	25 h.p.
Spindle speeds (45)	10-1300 r.p.m.	7·5-975 r.p.m.
Max. table cross travel	132"	132"

EQUIPMENT AVAILABLE includes
EXTENDED SADDLE AND SADDLE SUPPORTS with in- or over-the-floor type auxiliary runways.
IMPROVED MEASURING DEVICE giving readings to 0·0001".
AUTOMATIC ELECTRIC POSITIONING—positive settings within 0·0002".
HEAVY DUTY ANGULAR MILLING ATTACHMENTS.
CONTINUOUS FEED FACING AND BORING HEADS.
Many types of AUXILIARY and BUILT-IN ROTARY TABLES.
DAVIS SUPER MICROMETER STUB BORING TOOL SETS.

ROCKWELL
MACHINE TOOL CO. LTD.

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WELSH HARP, EDGWARE RD., LONDON, N.W.2. TEL: GLADSTONE 0038

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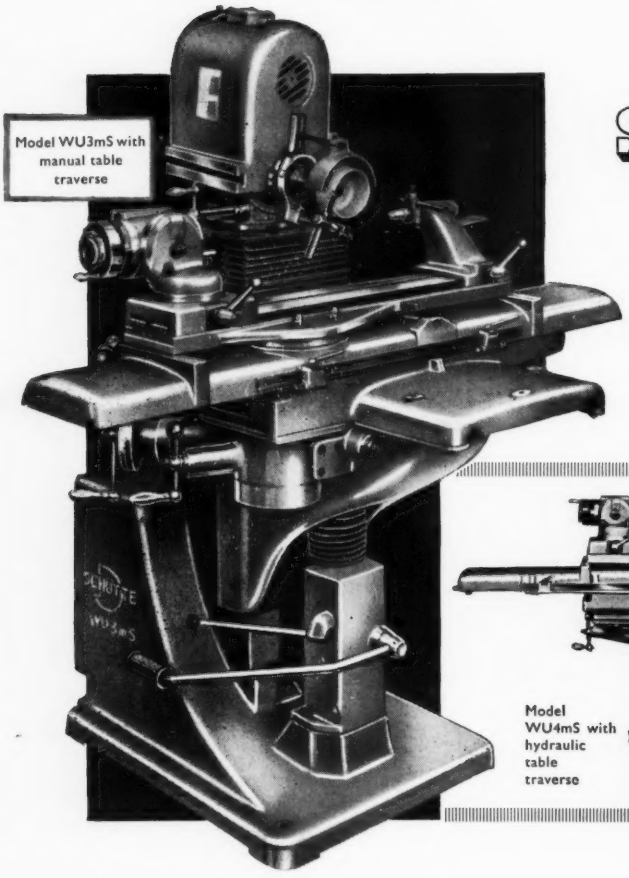
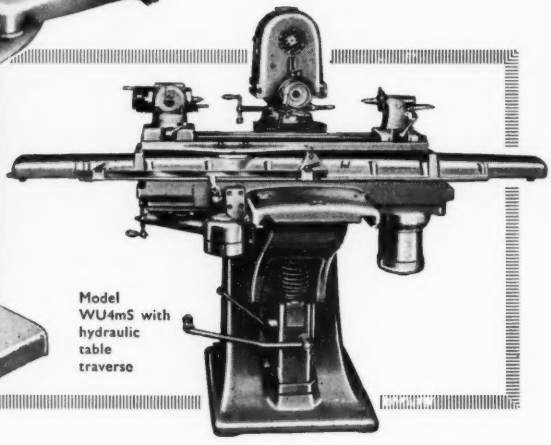
DIRECT SETTING of clearance angles on Straight *and SPIRAL* Cutters



SCHÜTTE

Universal TOOL & CUTTER GRINDERS



Wheelhead settings against direct reading scales
Wheelhead rotates through 360
tilts 12 either side of horizontal
helix adjustment 60 right or left
Table swivels through 90
Wide range of equipment—interchangeable on all models

NOTE: Hydraulic vertical adjustment of table for quicker, easier setting up

	WU2mS	WU3mS	WU4mS
Grinding diameter (standard)	10"	10"	10"
Grinding diameter with raising blocks	16"	16"	16"
Grinding length	12½"	20"	26"
Distance between centres (standard)	12½"	20"	26"
Distance between centres (special)		30"	40"
Spindle r.p.m.	3650, 6100	1100, 2200, 3000, 6000	1100, 2200, 3000, 6000

For further particulars write or telephone TODAY

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SCH 10

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DANGER

at a distance

That distance, whether it be governed by steel bars or wire mesh, can represent the difference between safety and serious injury. Machinery and tools—often running at high speeds—can be as productive of danger as any wild animal; and it is only good sense to cut this risk by using efficient and properly designed guards and fencing.

'Harco' Machinery Guards are purpose made for every type of machinery, and are constructed to afford complete protection without interfering with efficient operation. They are strongly made from stout wire mesh, and fully conform to Factory Act requirements.

The complete Harvey service covers advice, design and installation, and List No. 996 shows many types already supplied.

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Other HARVEY Facilities and Products: PERFORATED METALS · WOVEN WIRE · WIREWORK OF ALL KINDS · GALVANIZING · STEEL SHELVING AND STORAGE BINS · BAR AND TUBE RACKS · FABRICATIONS IN ALL METALS · MACHINING AND FITTING

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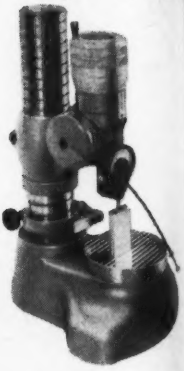

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0-6" to an accuracy of ± 0.00005" with one 4" Gauge Block! 2" Micrometer travel with ***pitch corrected Datum*** ensuring rapid setting for small run checking of Plug Gauges, Dial Indicator travel, small batches of cylindrical or flat components etc. without incurring Slip gauge wear.

The measured length is given independently of the Micrometer Head on a rotating dial at 5:1 magnification.

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Repeatability of result to ± 0.00002" £26 10 0 1"—2"
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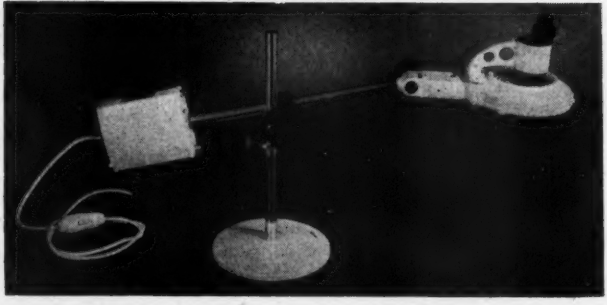
x 10 and x 20 instruments. Complete with Spot Lamp generally available from stock at **£36** each

FRIGOLUX LL1 ILLUMINATED MAGNIFIER WITH COLD CATHODE TUBE

Magnification x 2 or with prismatic Microscope x 9 and 14 ***all at a working distance of 6in.*** Ideally suitable for the examination of printed circuits, small precision components and semi-blind orifices.



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Two instruments from a very wide range of microscopes, precision tools and opto-mechanical measuring instruments.

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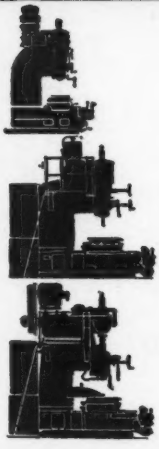
VERTICAL MILLING MACHINES

12 in. Carbiface Ardoloy-tipped inserted-tooth face milling cutter in use on a No. 49V machine.



No. 47V has the power, speeds, feeds and rigidity for milling materials from aluminium to high-tensile steels. 32 speeds, 21 to 1525 r.p.m.; twenty-four feeds ¾ in. to 60 in. per min.; quick-power traverse to longitudinal motion. 48 in. by 16 in. by 23 in.

No. 49V. For heavy work requiring large table capacity. 32 speeds, 21 to 1525 r.p.m. Electronic feed drive, infinitely variable feeds from 0·8 in. to 40 in. per min. Quick-power traverse to longitudinal and traverse motions. 62 in. by 29 in. by 28½in.

No. 28A. For heaviest class of work. 32 speeds, 12 to 540 r.p.m. Electronic feed drive, infinite variable feeds between 0·8 in. and 40 in. per min. Quick-power traverse to longitudinal and traverse motions. 62 in. by 29 in. by 30½in.

All models now available for Early Delivery.

ALFRED HERBERT LTD., COVENTRY

AD.471

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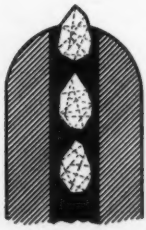
KNOW YOUR DIAMOND

Physical properties

Properly applied, diamond is the supreme cutting material because it is the hardest substance known.
It is about five times as hard as tungsten carbide or corundum, and this property is derived from the enormously high temperatures and pressures under which it is formed.
The use of diamond for cutting purposes, however, poses special problems, since its strength does not match its hardness. Tensile strength, clearly, is unimportant in this context, but the low compressive strength demands that diamond tools be carefully handled, while adequate support of the stone is necessary to counter the relative weakness in shear.



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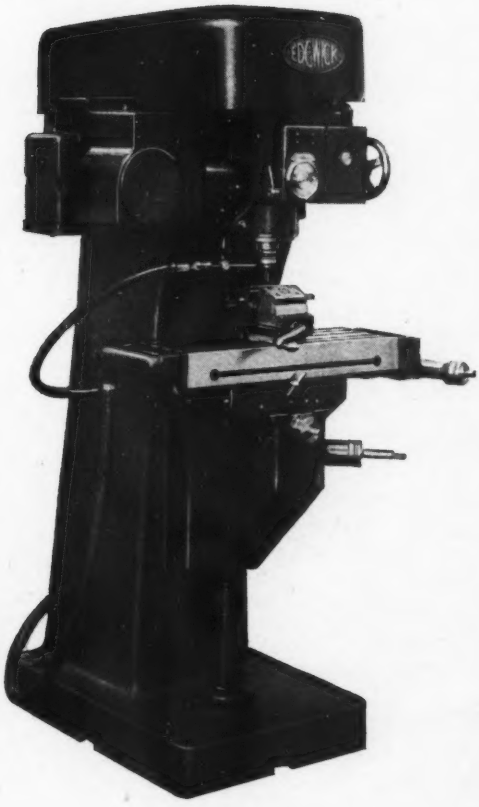
L.M. VAN MOPPES & SONS (DIAMOND TOOLS) LTD
BASINGSTOKE · HAMPSHIRE · ENGLAND

TELEPHONE: BASINGSTOKE 1240 TELEGRAMS: DIATIPT, BASINGSTOKE

— for fast, accurate machining of keyways, slots, splines, etc., the —

EDGWICK KEYSEATER



This machine is designed to machine a keyseat by the well-known principle of a series of light cuts with a reciprocating cutter slide and a sequence down-feed.

On general toolroom work the machine can be used to advantage as a light hand-feed vertical milling machine.

Max. keyway cut, auto crank drive and table adjustment, ¾" x 20". (at one setting of the table ¾" x 5").

Max. depth of keyway cut, automatic, 2¾".

ALFRED HERBERT LTD., COVENTRY Factored Division, Red Lane Works.

AD.546

500 every hour

pendulum milled on the

CENTEC 'AUTOMIL'

WITH HYDRO-PNEUMATIC TABLE DRIVE

- * LOADING TIME ELIMINATED
- * 14" TRAVERSE
- * FAST TRAVERSE 420" PER MINUTE
- * WORKS ON STANDARD AIR LINE PRESSURE
- * GIVES AUTOMATIC CYCLE PRODUCTION MILLING
- * PENDULUM MILLING INVOLVING CONVENTIONAL AND CLIMB MILLING

At Hollands & Blair Ltd., Croydon, components for the FARVALUBE personal weighing machine, as shown above, are produced at consistently fast rates on the CENTEC 'AUTOMIL'
The combination of hydro-pneumatic table drive, air-operated fixtures and pendulum milling cycle, ensure the lowest possible production times.

OPTIONAL EXTRAS: ● AUTO PNEUMATIC INDEXING TABLE
● VERTICAL SWIVELLING HEAD FOR MILLING AND DRILLING AT ALL ANGLES

Write for 'AUTOMIL' times on your own work

Send drawings and samples for quotation

CENTEC MACHINE TOOLS LTD., Centec Works, Hemel Hempstead, Herts. BOXMOOR 584/5/6

☆ **STAND 9215 at the BRUSSELS EXHIBITION**

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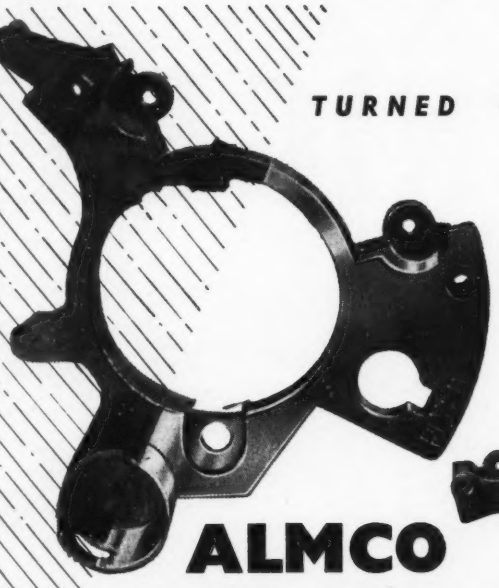

ALMCO
SPEED FINISHING

GIVES THE SAME UNIFORM FINISH EVERY TIME TEN TIMES FASTER

Using Almco Supersheen barrel-finishing equipment and materials, *unskilled* operators can turn out *precision* DEBURRING, DESCALING, BURNISHING, POLISHING, etc., with practically no rejects, with savings of up to 87%, at ten times the speed of hand-finishing.

To prove to yourself that such savings are realities, we invite you to send any unfinished component you choose to our development laboratory where it will be processed FREE OF CHARGE. Its finished appearance—together with the detailed report provided—will convince you that Almco products are *essential* in keeping pace with modern production methods.

Why not ask us to call? Or, better still, call and see your own products undergoing processing.

ALMCO

Supersheen

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Telephone: Hitchin 3669

A Division of the King Seeley Corporation, Ann Arbour, Michigan, U.S.A.

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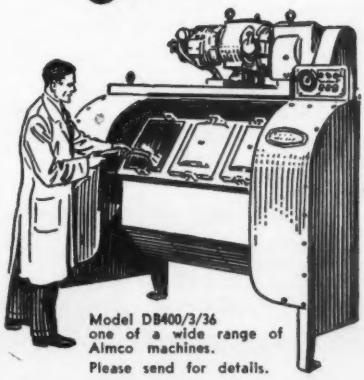

Model DB400/3/36 one of a wide range of Almco machines.
Please send for details.

KAMENICEK

UNIVERSAL TOOL & CUTTER GRINDER

Model 102

SPECIFICATION

Swing over table	11"
Swing over table (with raising blocks)	14½"
Length between workhead and tailstock centres	19⅜"
Length between right and left-hand tailstock centres	27½"
Standard dimensions of grinding wheel :	
External dia.	5⅞"
Internal dia.	⅜"
Width	⅛"
Maximum dimensions of grinding wheel :	
External dia.	7⅞"
Internal dia.	1½"
Width	½"
Diameter of spindle for internal grinding	2½"
Workhead swivels horizontally and vertically	360°
Table swivels	90°
Swivel movements of grinding wheelhead	350°
Working surface of table 36½" x 5½"	

- ***Designed and built for grinding a very wide range of cutters.***
- ***Robustly constructed with complete rigidity throughout ensuring a high degree of accuracy.***
- ***Easy in manipulation and set-up.***

Immediate Delivery from London Stock

SOLE AGENTS

Selson MACHINE TOOLS

The Selson Machine Tool Co. Ltd

SUNBEAM ROAD, LONDON, N.W.10. Telephone Elgar 4000

STANNINGLEY, Near LEEDS Telephone Pudsey 2241

And at Kingsbury (Nr. Tamworth). Manchester. Glasgow. Swansea. Newcastle-on-Tyne. Sheffield. Southampton. Belfast. Bath.

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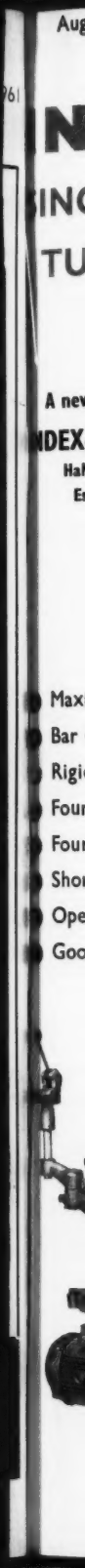


INDEX DG12

SINGLE SPINDLE TURRET AUTOMATIC

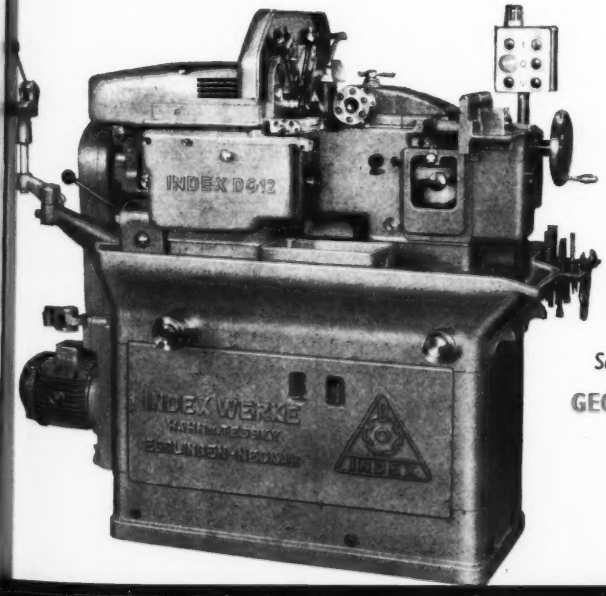
A new design from

INDEX-WERKE K.G.

Hahn and Tessky

Esslingen A.N.

- Maximum Spindle Speed—9,000 r.p.m.
- Bar Capacity—½"
- Rigid, vibration free spindle
- Four robust cross slides
- Four spindle speeds in one work cycle
- Short idle times
- Open front design
- Good accessibility for setting



Exhibited at The 7th European Machine Tool Exhibition — Brussels

3rd—12th September, 1961

Hall 2 — Stand 2103

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HACKSAW BLADES

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we started to save

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EUROPEAN MACHINE
TOOL EXHIBITION
BRUSSELS 3rd-12th Sept.

P. HURÉ

HIGH QUALITY UNIVERSAL MILLING MACHINES

IMMEDIATE DELIVERY FROM SOUTHAMPTON STOCK FOR MODEL 402-A

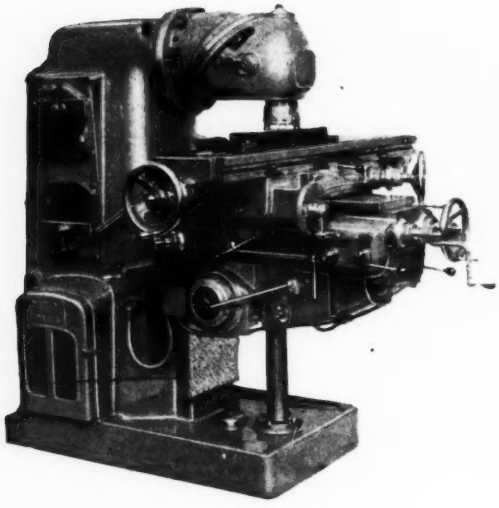


ILLUSTRATION OF TYPICAL KNEE MODEL

Brief Details :—

- 19 Speeds 20-1,250 r.p.m.
- 24 Feeds in three directions.
- Rapid Power Traverses.
- Table 50in. by 11¼in.
- Head will set to any compound angle.
- Diameters of Swivel Bearing Surface on head:—

  At 90 degs. .....13⅞in.
  At 45 degs. .....13¼in.

OTHER MODELS	KNEE TYPE		KNEELESS TYPE
TABLE SIZES	40in. by 10in.	59in. by 14¾in.	110in. by 27½in.
SPINDLE SPEEDS	24—1,800	20—1,250	10—1,000

SOLE AGENTS IN BRITISH ISLES

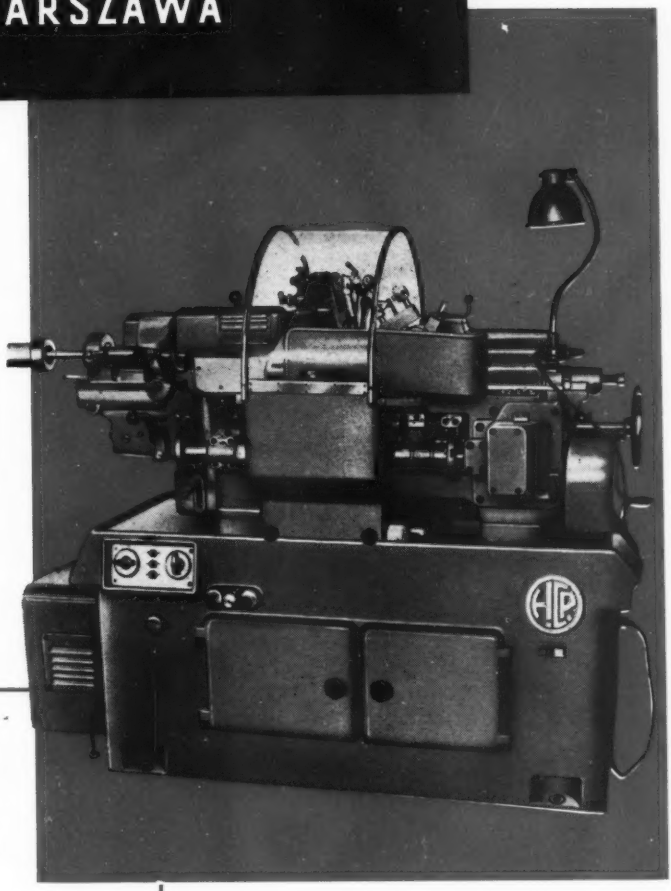
SOUTHERN ENGINEERING & MACHINERY COMPANY
MILLBROOK SOUTHAMPTON
PHONE: SOUTHAMPTON 73101/2/3

METALEXPORT
WARSZAWA

Invite you to the

POLISH MACHINE-TOOLS SHOW ROOM
in
BRUSSELS
32 rue de Brabant
phone 17-04-66

September 2nd to 20th, 1961
9 a.m. till 6 p.m.



The following machines chosen from our ample export range will be exhibited at the SHOWROOM

AUTOMATIC LATHE ATL-40
AUTOMATIC LATHE BPU-4
AUTOMATIC LATHE BPU-12
UNIVERSAL LATHE TUB-32
PRODUCTION COPYING LATHE TPD-24
UNIVERSAL MILLING MACHINE FWA-31
VERTICAL MILLING MACHINE FYC-25
HYDRAULIC SAW CRB-710
RADIAL DRILLING MACHINE Wrs-25/08
UNIVERSAL GRINDING MACHINE SWA-25

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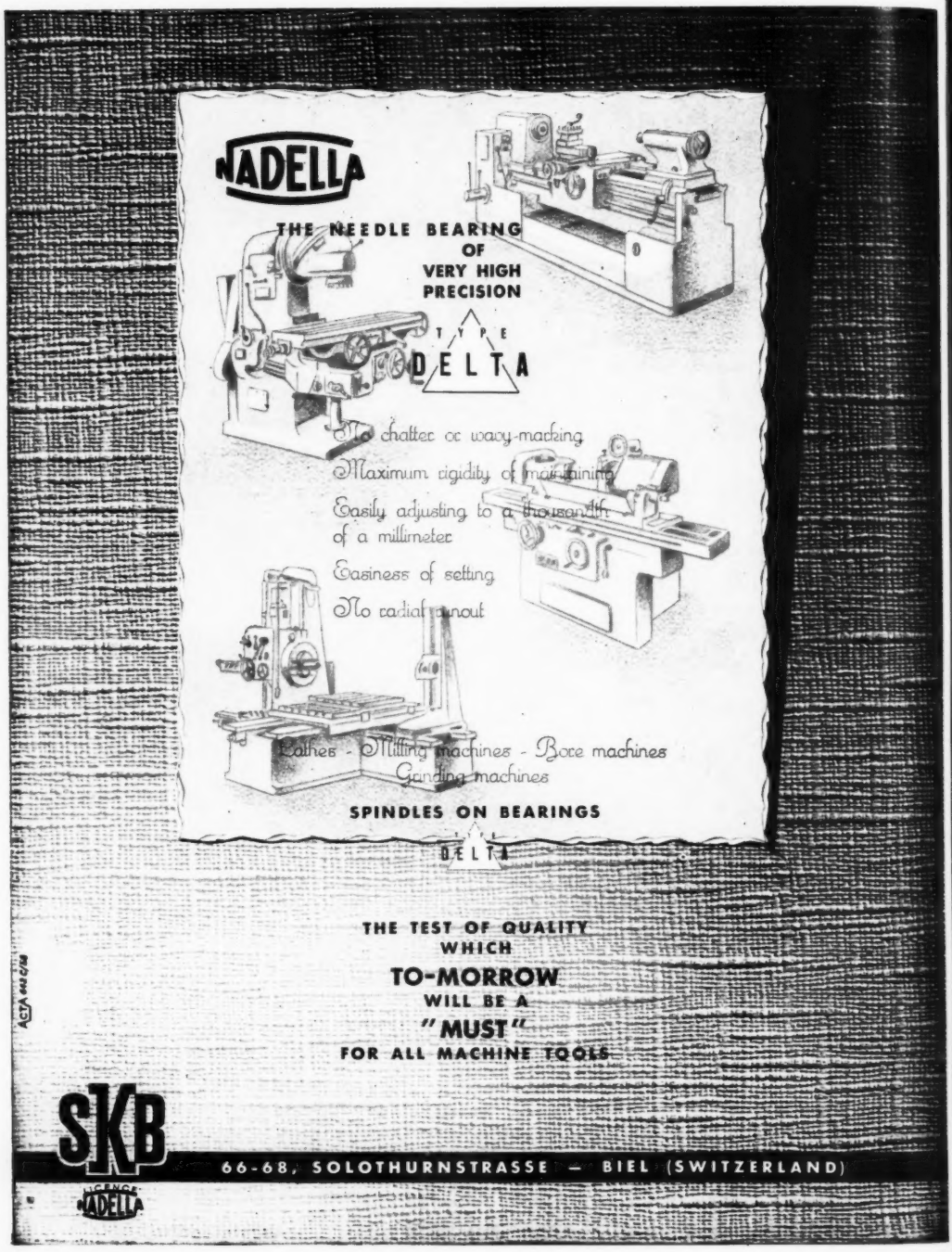

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SANDVIK Coromant NEWS

3 *Increased production resources, now give us the opportunity of presenting,*

New Tool Designs

T-maX "Throw-away" cutters

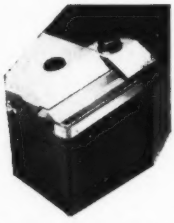
A cutter design with throw-away economy, and the versatility of a cutter with brazed blades.

Special features:—

- **Sturdy design, with easily replaceable parts.**
- **Superior economy. The cutter can be supplied with inserts of different sizes, negative as well as positive.**
- **Gives a high surface finish. The design has been specially conceived around this feature.**

T-maX Micro-blade

This revolutionary and bold idea, with a so-called "micro-blade", is now about to leave the development stage.



This tool, which in the first place is intended for cutting depths of over 1in., opens up new possibilities to improve machining economy within a range so far untouched.

T-maX Toolholder with Rhomboid inserts for Copy-Turning

The copy turning tool range which includes brazed tools, toolholders with long inserts, and throw-away tools of the T-maX type with triangular standard inserts, is now extended by including this new holder.

Special features:—

- **A 55° nose angle gives good accessibility with most copying operations.**
- **Robust design with sound clamping of the throw-away blade.**
- **Positive cutting rake with 0° front-to-back rake allows machining of slender work-pieces.**
- **With sintered chipbreakers—a guarantee of reliability even with the small nose angle involved.**

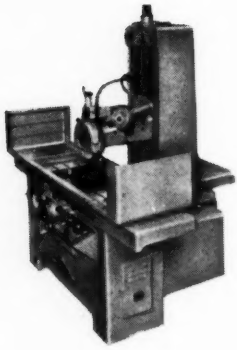
See these new Sandvik tools demonstrated on STAND 3209 Hall 3—Brussels Fair, Sept. 3rd-12th.

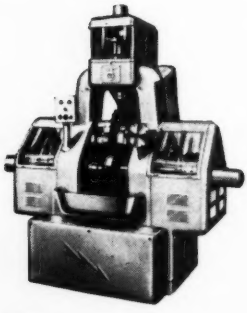
SANDVIK SWEDISH STEELS LTD.

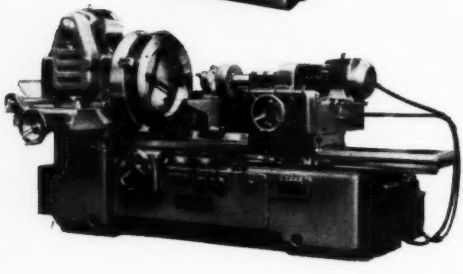
MANOR LANE, HALESOWEN, BIRMINGHAM. Telephone: Halesowen 2121 (10 lines). Telex: 33164.

Scottish Warehouse at: Blackbraes Road, Nerston Industrial Area, East Kilbride, Glasgow. Telephone: Murray 429.

SEVENTH EUROPEAN MACHINE TOOL EXHIBITION







The Brussels Machine Tool Exhibition offers an opportunity to see a large part of our extensive, yet highly specialised Machine Tool Sales Programme.

Manufacturers on the Stands listed below will be keenly interested in your problems and you can be sure of receiving every attention from their technicians and our own Representatives.

BERTHIEZ—HALL 5, STAND 5205
Vertical Borers, Planers and Plano-Millers, Vertical Grinders

DANSK—HALL 8, STAND 8032
Open-fronted, fixed and inclinable Presses, double-sided presses

DUTRANNOIT—HALL 8, STAND 8103
Press Brakes, Guillotines, Punching and Shearing Machines, Slotters

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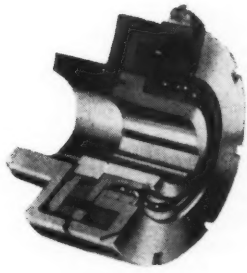

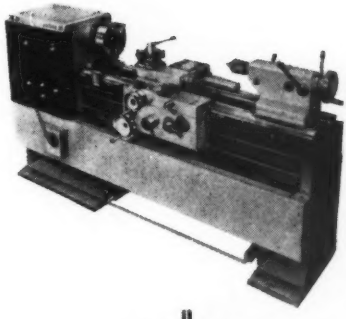

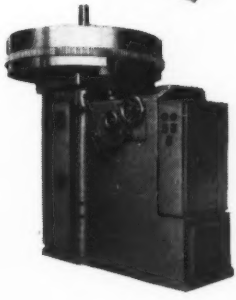

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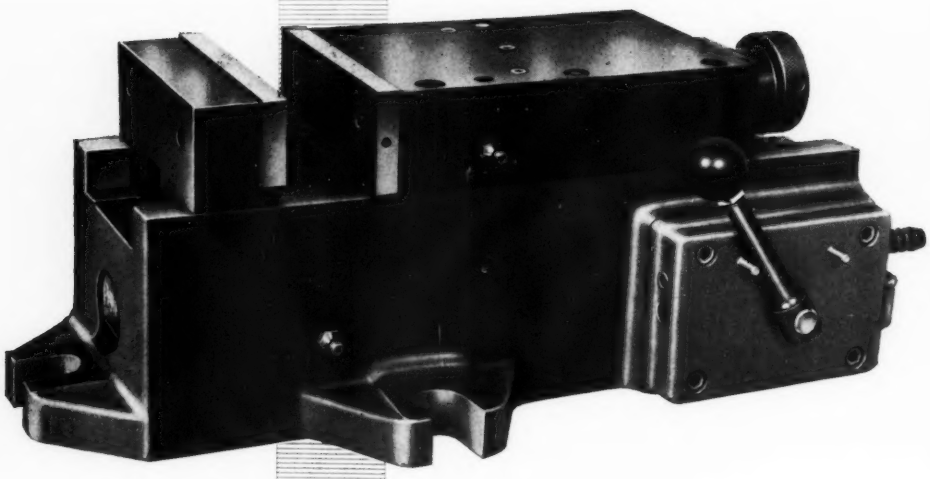

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Width of Jaw	4⅛"	6"
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Power Movement	1"	1"
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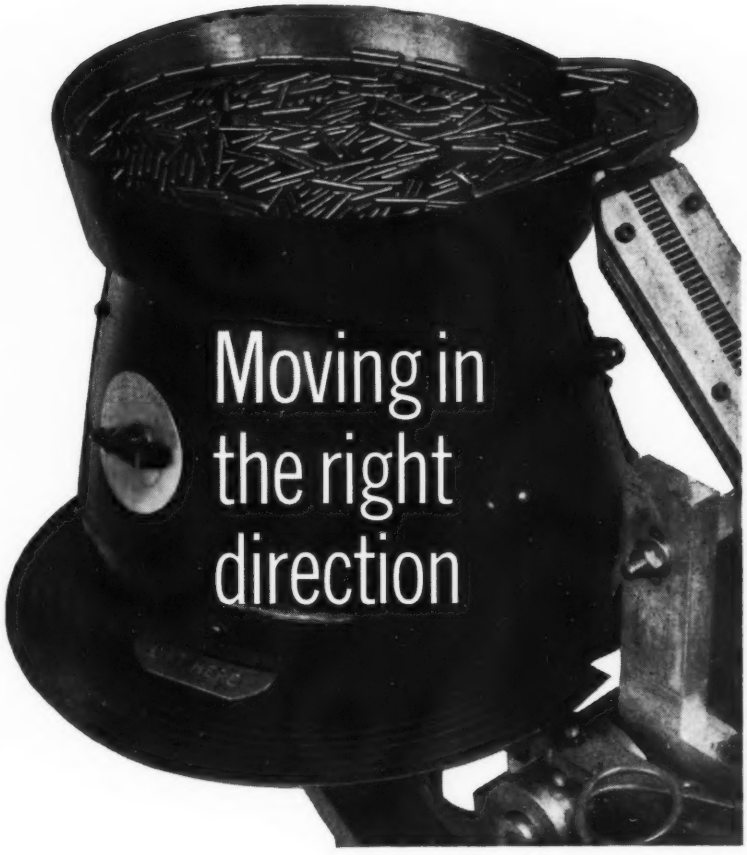

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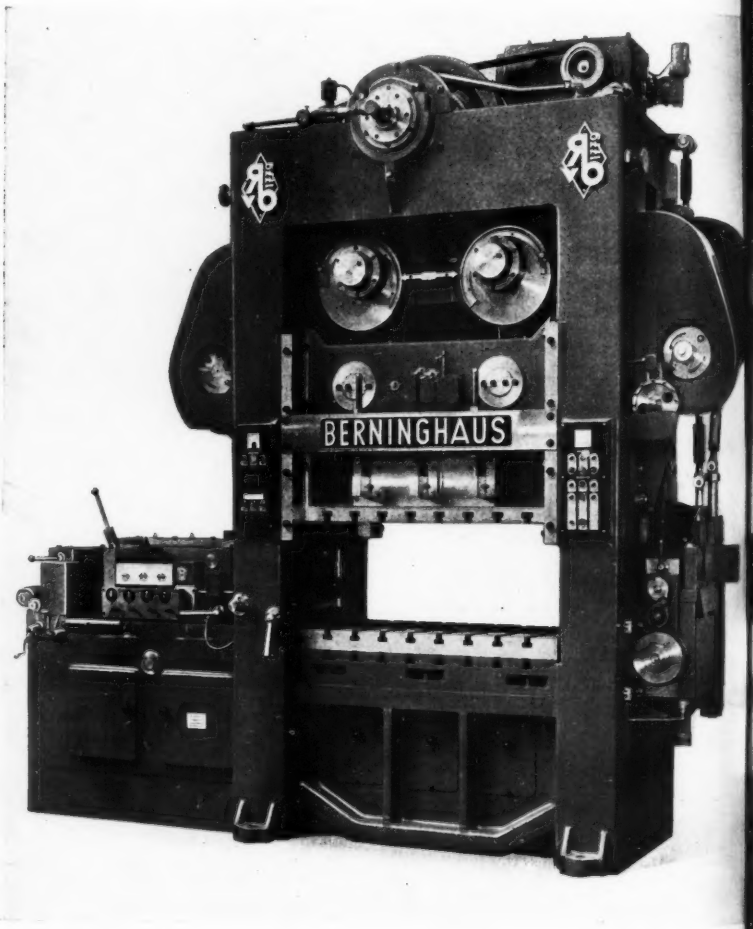

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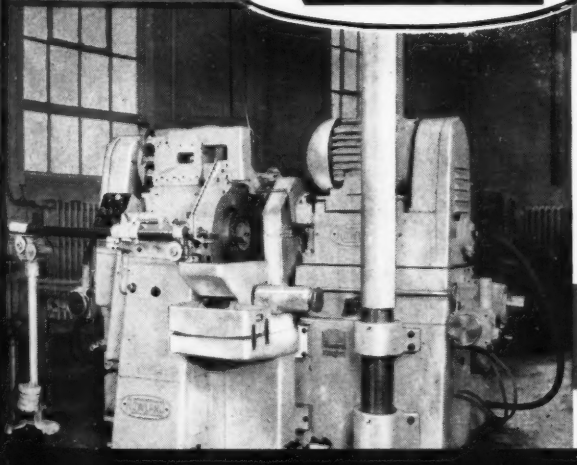

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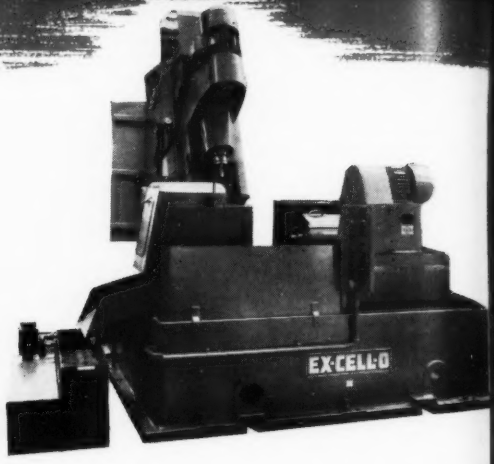

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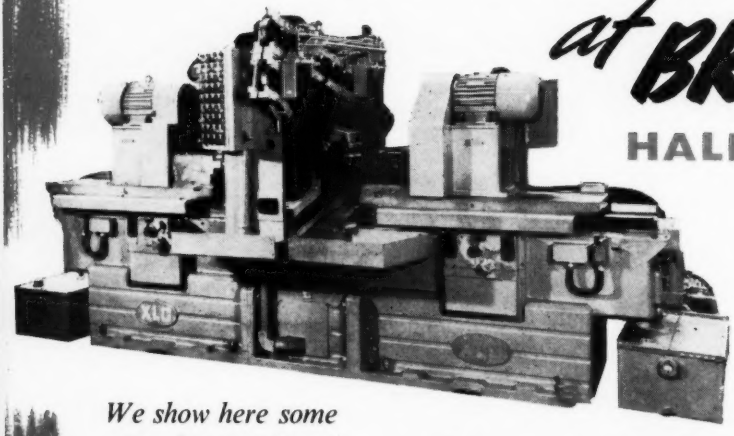

We show here some typical examples of

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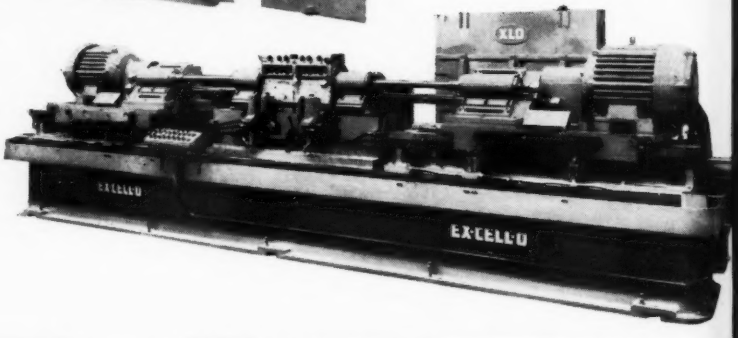

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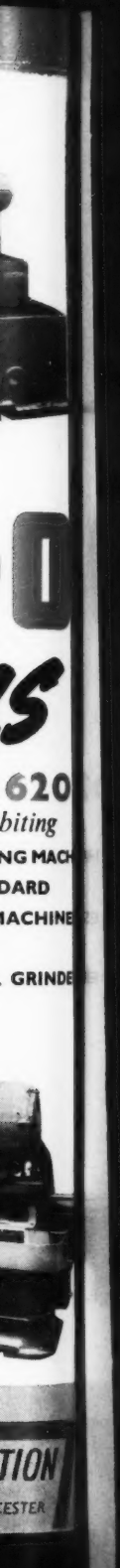
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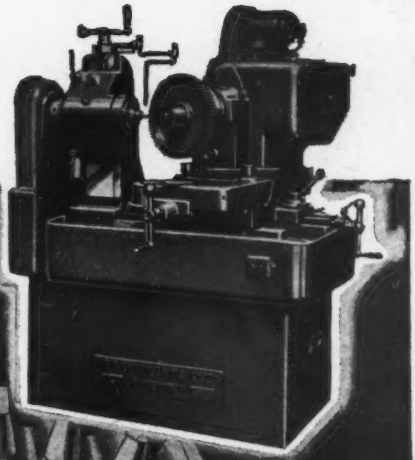

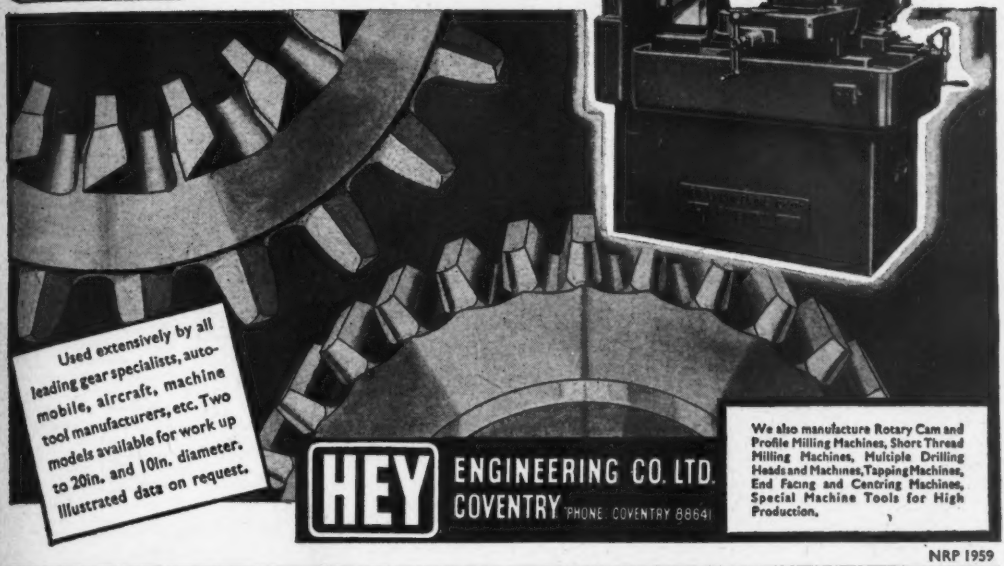

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Facing $\frac{1}{8}$" off each end and drilling $\frac{7}{16}$" centres in $2\frac{1}{2}$" diameter Electric Motor Shafts in a floor to floor time of 27 seconds, is typical of the high production which can be achieved on the —

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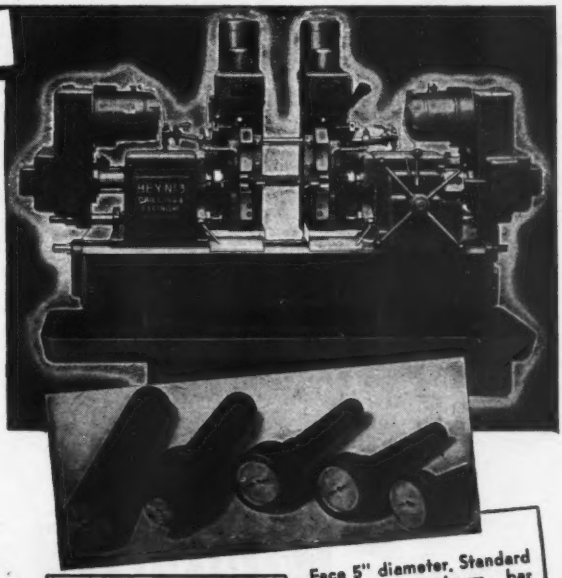

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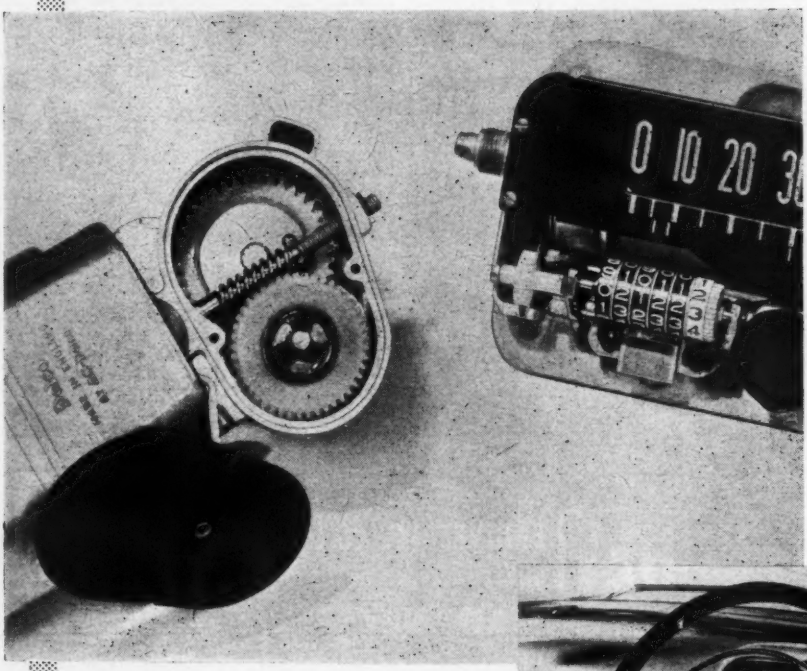
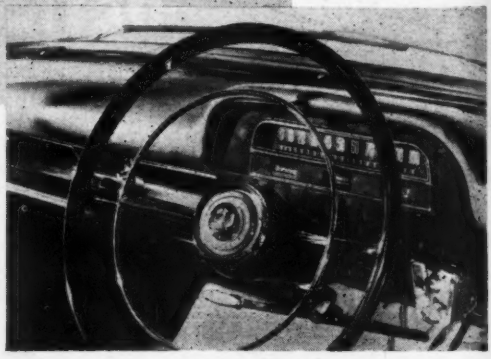


AC combined instrument panel and Delco windscreen wiper motor, showing gear wheels moulded from 'Maranyl' I.C.I. nylon by Messrs. Punfield and Barstow (Mouldings) Ltd., Basil Works, Westmoreland Road, London N.W.9. The instrument panel is fitted to Vauxhall Cresta and Veloz cars and the windscreen wiper motor to the Bedford TK Truck. Both units are made by AC-Delco Division of General Motors Ltd., Dunstable.



'Maranyl' I.C.I. nylon helps the smooth, silent running of the Cresta

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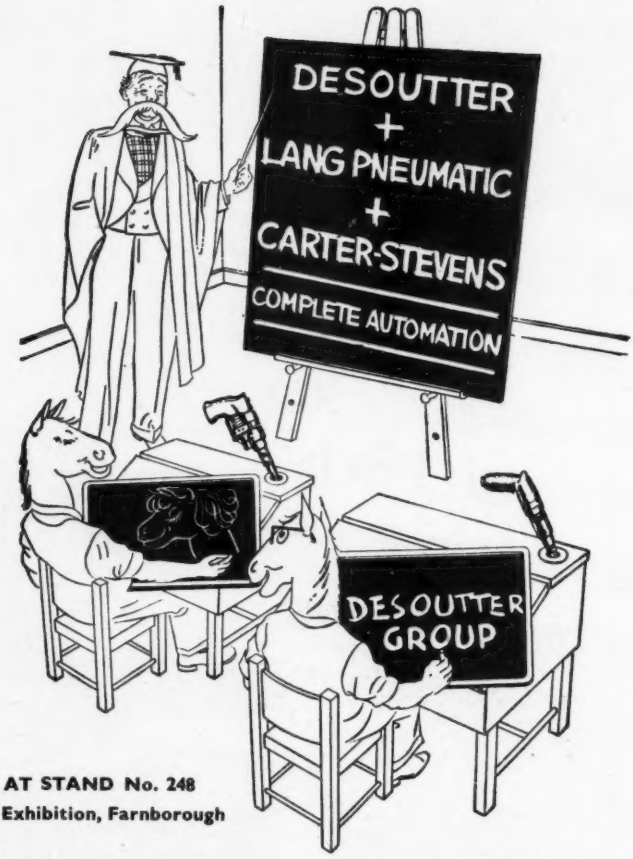

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"Couldn't it be a woman, sir?" asked one Little Horse who had been reading Lolita under the desk.

"Depends whether it's at overtime rates," said the pedant of the class.

"Wrong, wrong," cried the M.D. triumphantly, "you're all wrong! The answer is NONE, because it's a Desoutter eight-spindle multiple nutrunner, controlled by Lang Pneumatic Valves and built by Carter Stevens into an automatic machine!"

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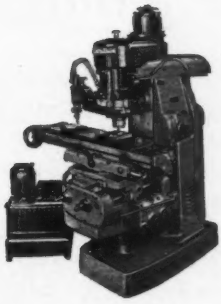
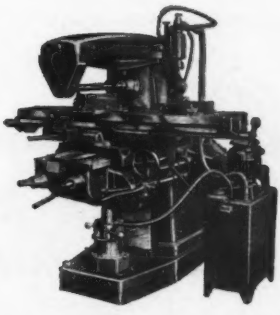
Suitable for fitting to an existing Plain or Universal Horizontal Milling Machine. This attachment has its own motor-driven eight-speed spindle with rise and fall quill controlled by the Hydraulic Tracer. This model is available in three sizes.



Model FRT.

is supplied in two sizes for Horizontal Milling Machine sizes 1 & and 3 & 4 respectively. The attachment is applied to the vertical traverse of the knee on the front column of the machine which is controlled by the hydraulic tracer mounted above the table.



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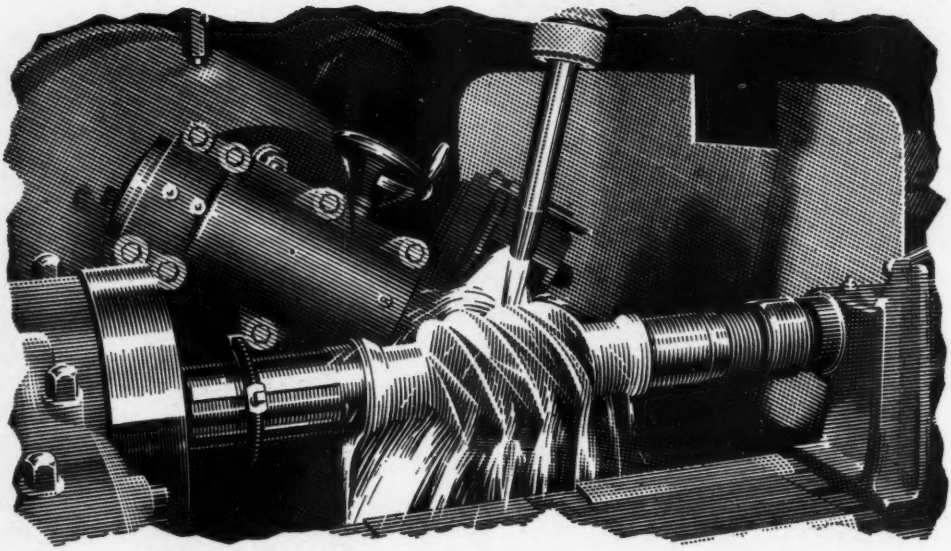

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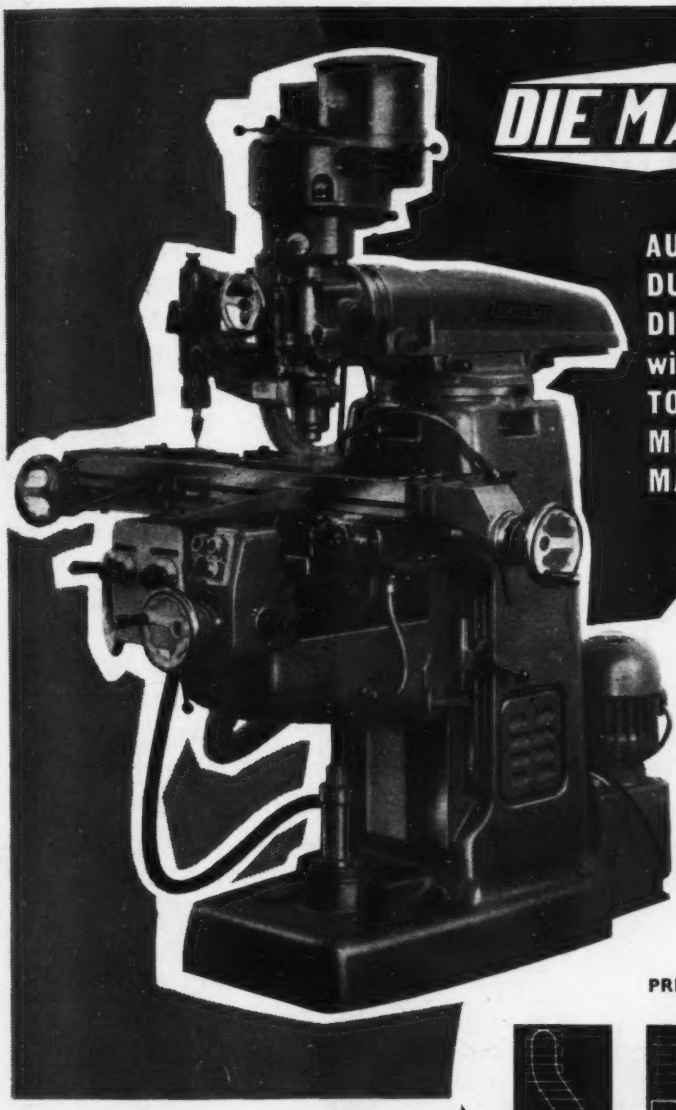

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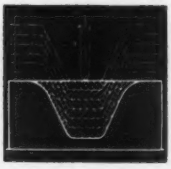

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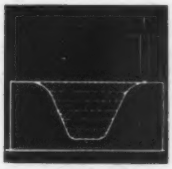

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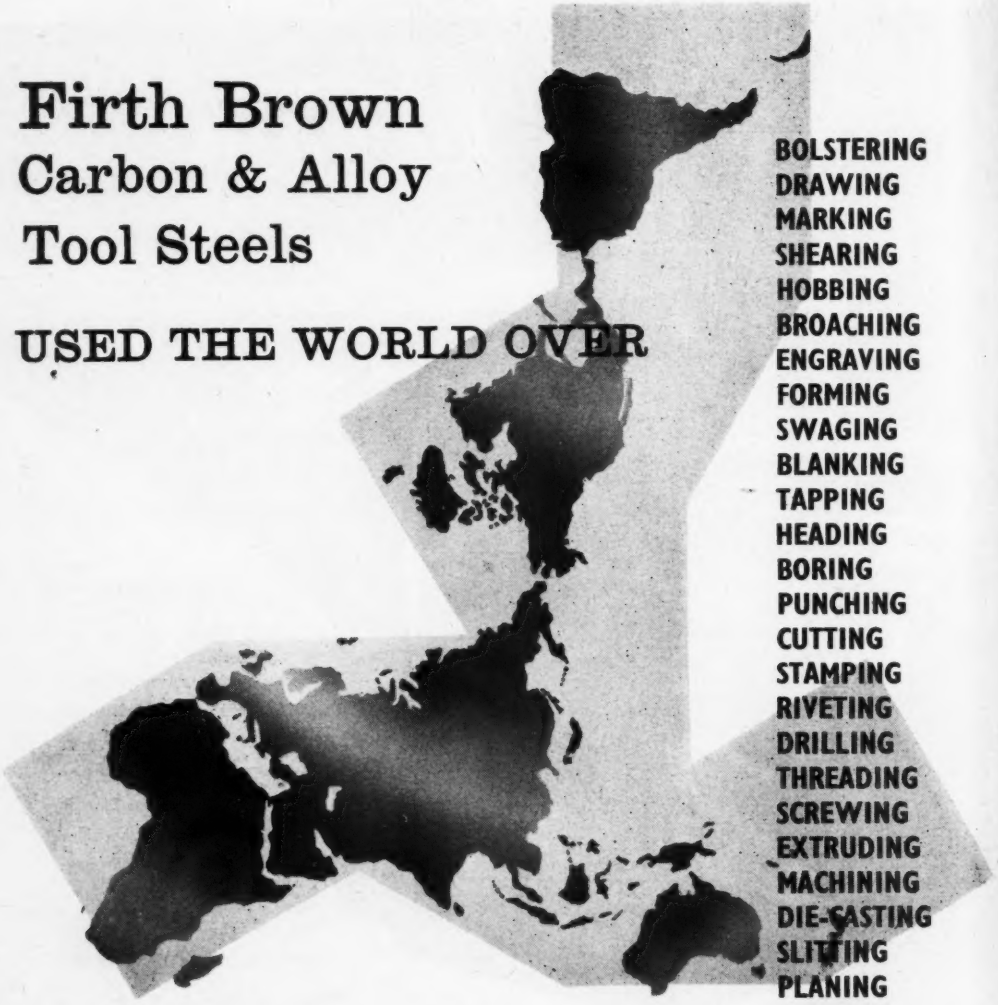

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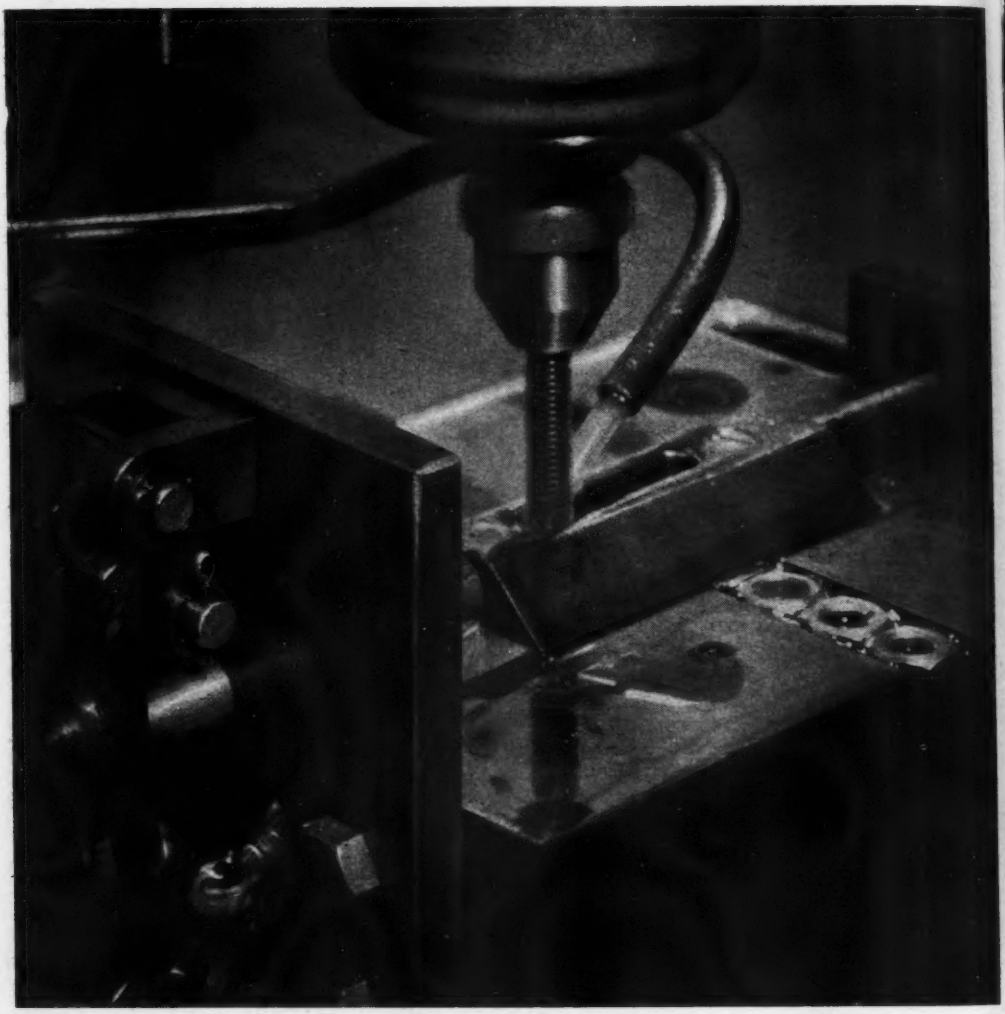

A famous aero-engine firm found it could drastically reduce the cost of producing nuts made from S.62 steel, by changing over from conventional cutting oils to Shell Garia Oil 115. The facts are these. S.62 steel is heat-resistant and stainless. The quality of this steel and the call for very fine tolerances, as well as a very high percentage of full depth of thread, presented costly manufacturing problems. The breakage of taps, the need for constant re-setting, and the high proportion of rejects, built up the average cost of the nuts to over 1/2d. each.

By accepting the advice of the Shell engineer and changing over to Shell Garia Oil 115, this firm was able to produce 3,000 nuts between regrinding taps – resulting in the cost of each nut being reduced to 3d.

Write for the booklet 'Selecting Your Cutting Oils' to Shell-Mex House, London, W.C.2

SHELL

SHELL INDUSTRIAL OILS

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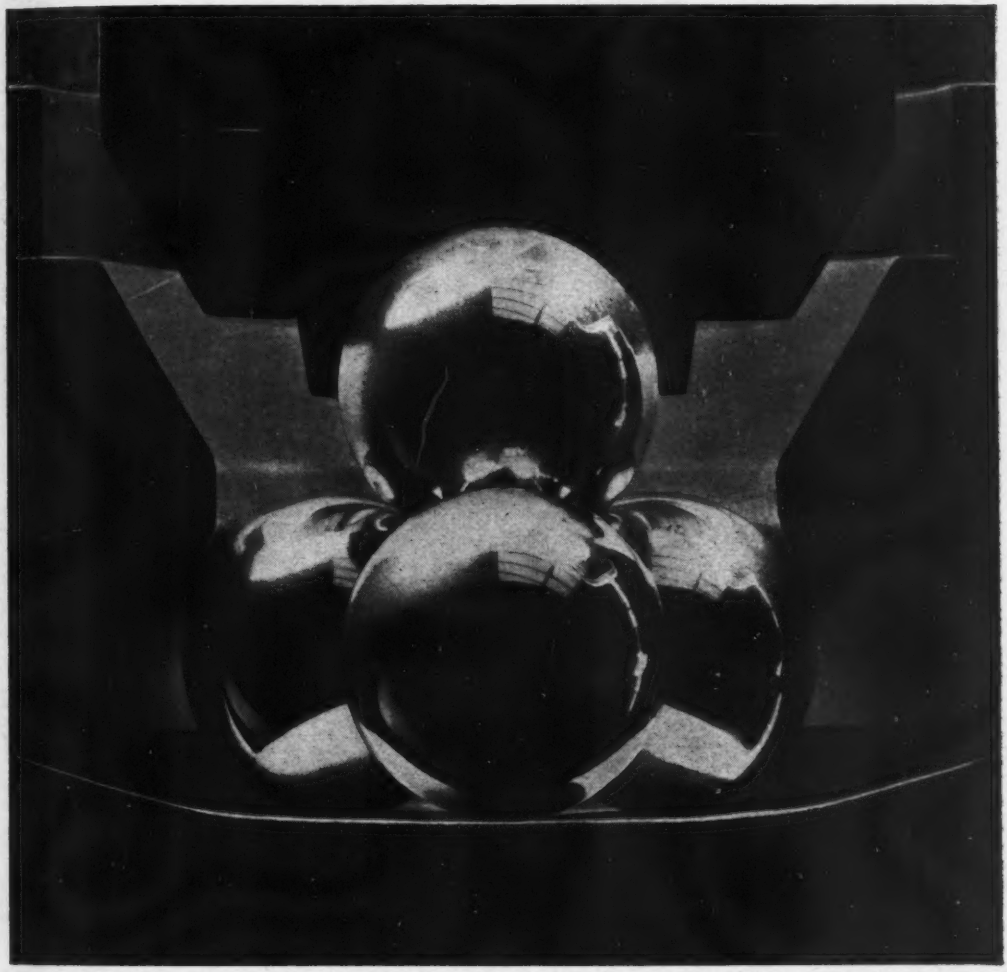
Shell demonstration



To establish *facts* is the constant preoccupation of Shell research. Assumptions cut no ice.
For example, how 'extreme' is 'Extreme' Pressure? To evaluate scientifically the respective performance of the many E.P. agents evolved, Shell devised the Four Ball Test machine illustrated. In this apparatus a clamped ½" diameter steel ball revolves in contact with three identical static balls in a metal cup containing the additive to be tested. Pressure between the balls can be varied at will. Under these controlled rubbing conditions, coefficients of friction can be plotted against load. With increasing loads, wear scars formed at successive stages may be measured and the welding point accurately determined. Developed for basic research, the Four Ball Test also plays an important workaday role in ensuring consistent batch quality—of prime importance on the machine-shop floor. Thoughtful production executives who want to know more have only to write for the book.
'Selecting Your Cutting Oils', to Lubricants Dept., Shell-Mex House, London, W.C.2.

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**FROM 9¾in. to 63in.
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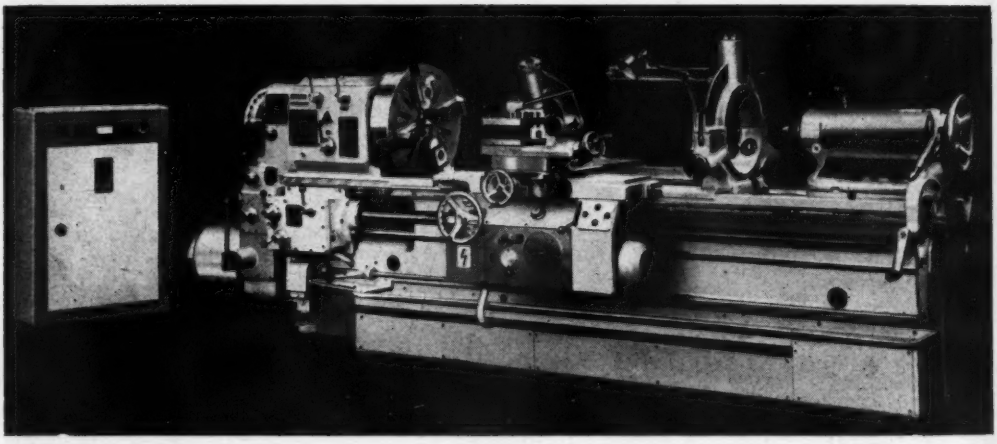
AND UP TO 150 H.P.**

Several models available for early delivery



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Model SU 63a (illustrated) 20 H.P.
25in. swing by 80in. between centres
with rapid traverse to saddle.

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at the Exclusive distributors in the U.K.

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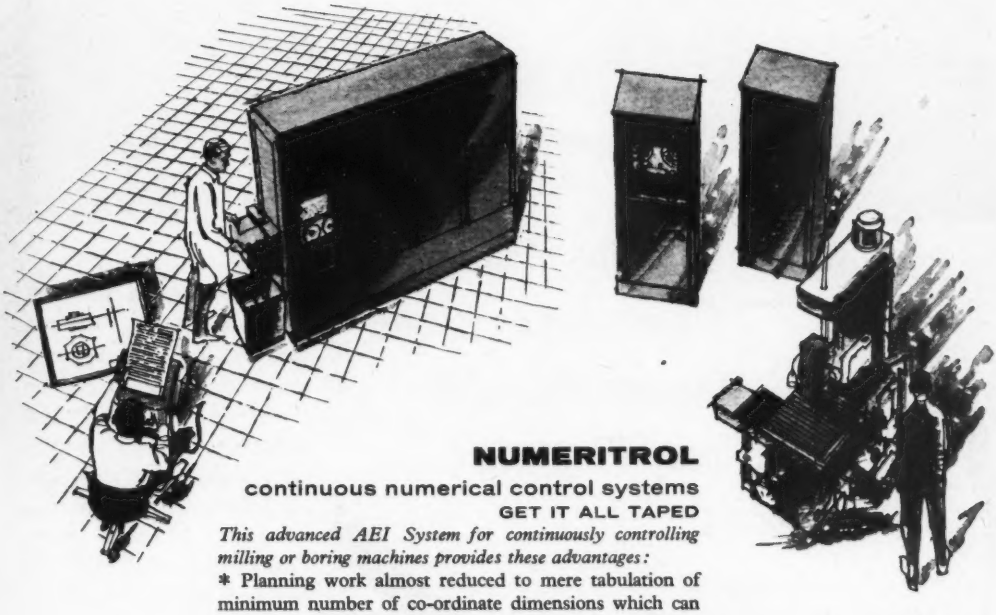
AEI equipments featured on the stands of: The Newall Engineering Company Limited, Drummond-Asquith Limited, Kendall and Gent Limited.



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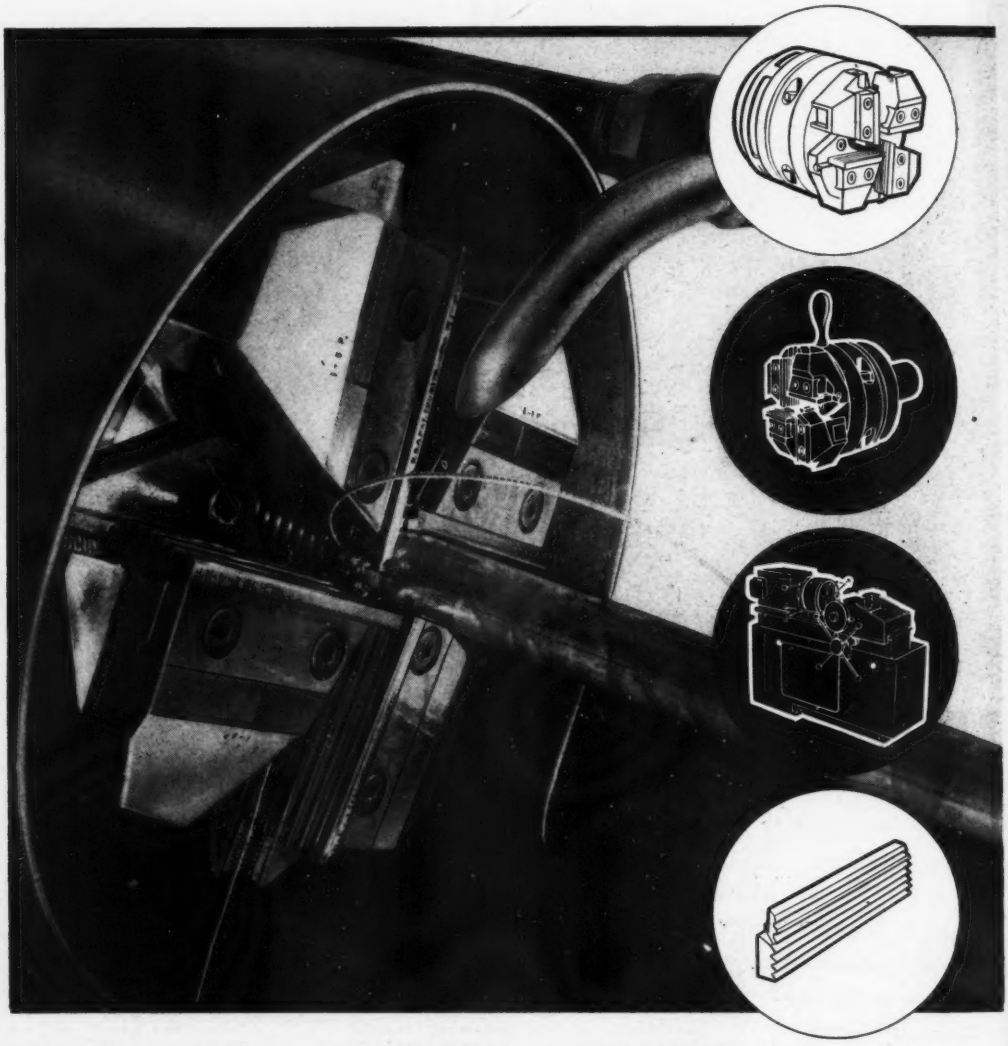

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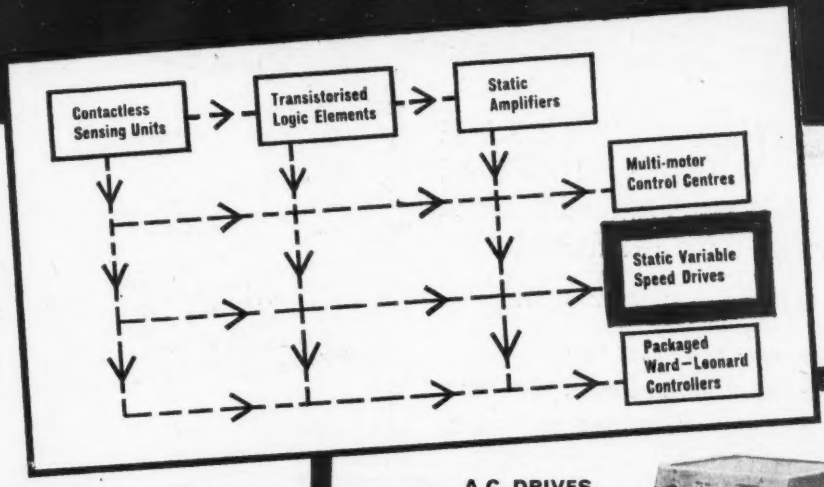

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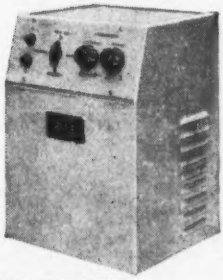

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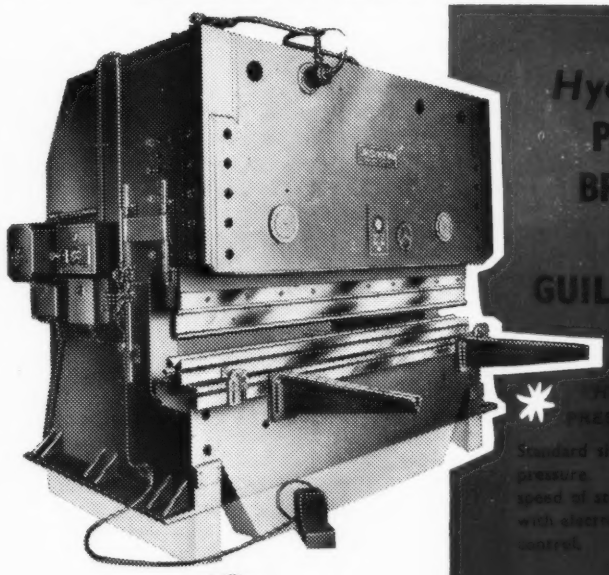

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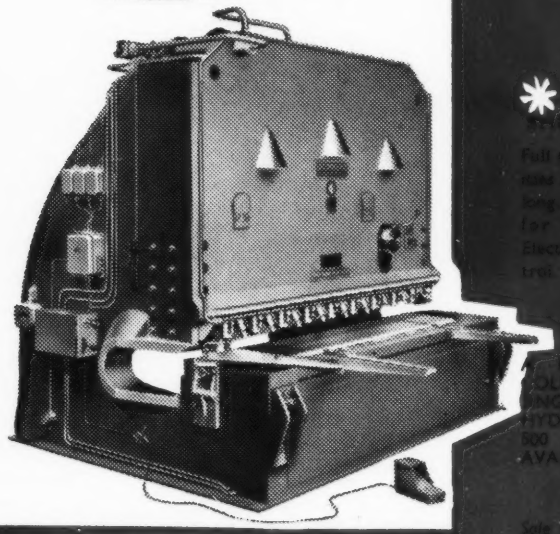

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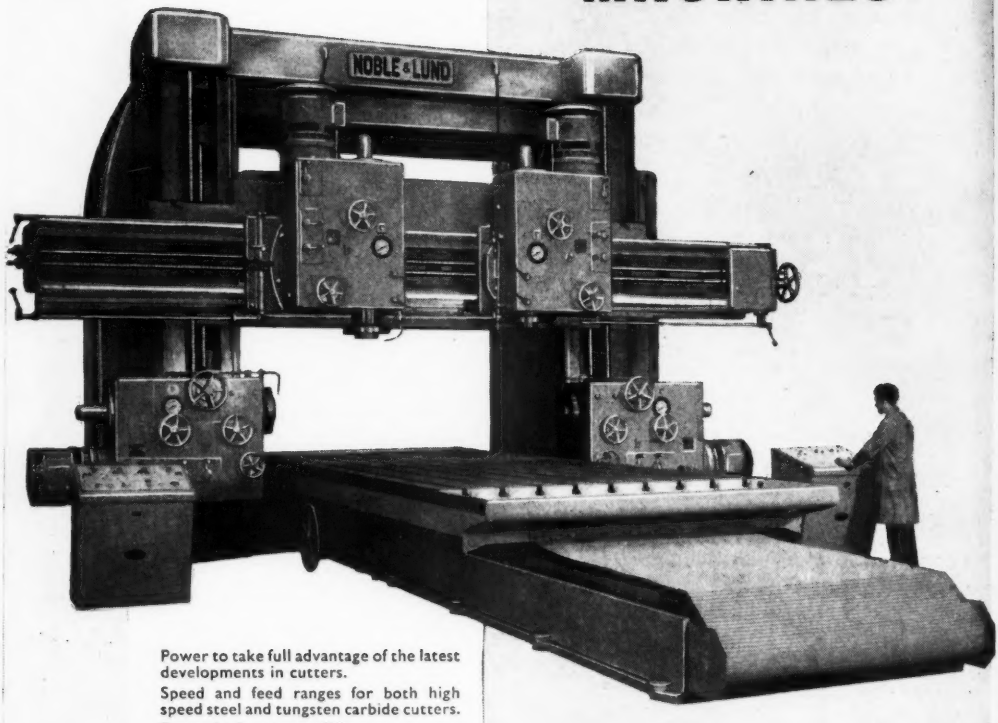

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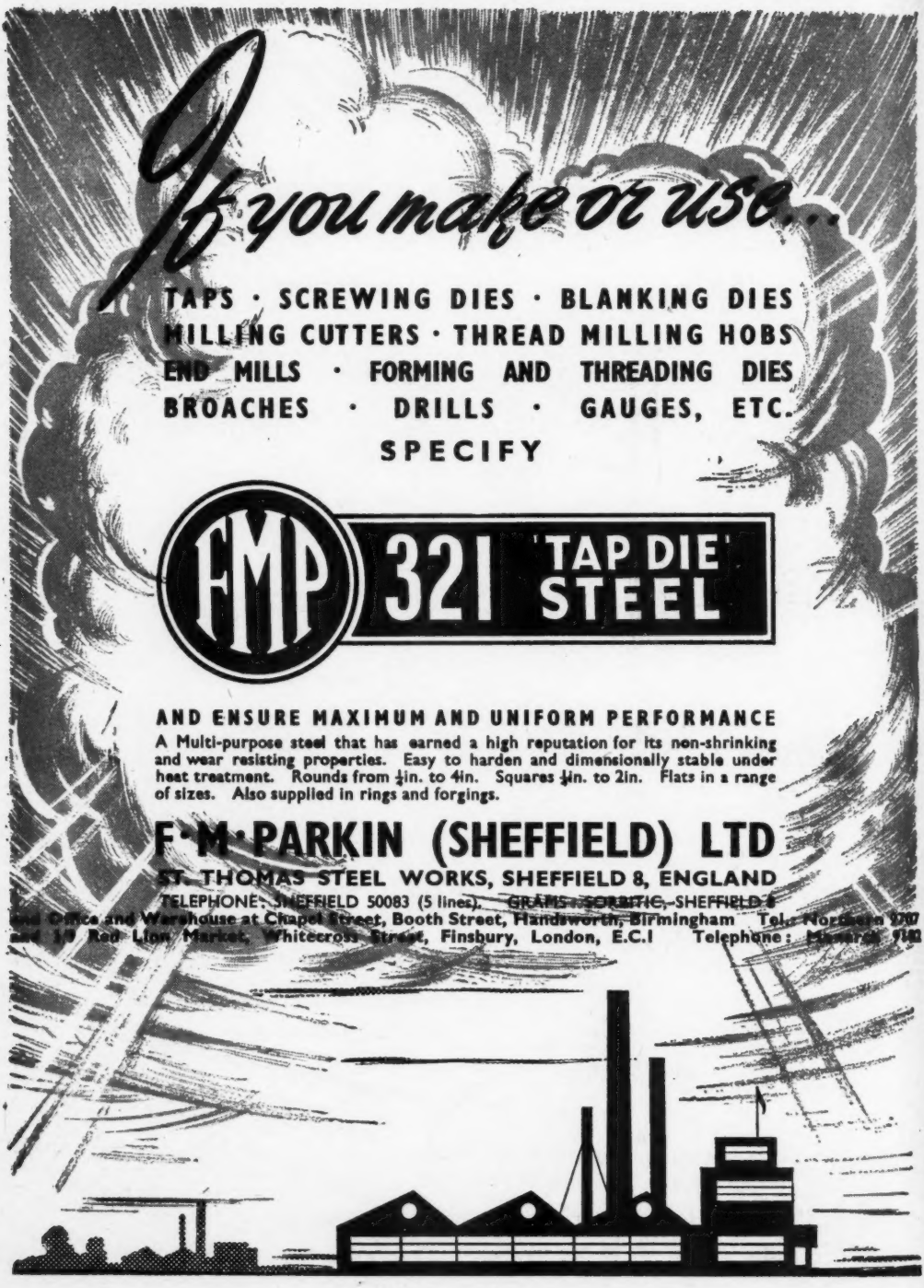
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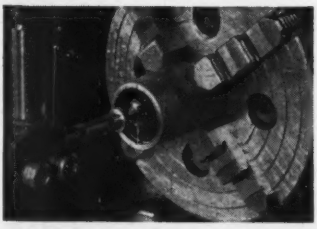

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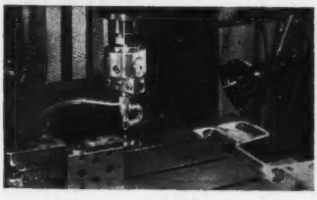

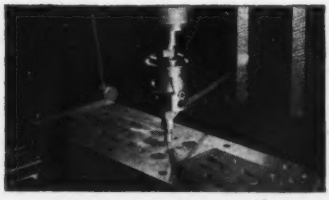

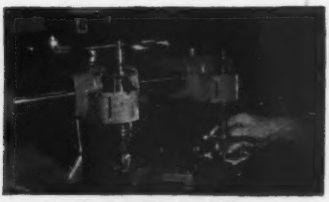

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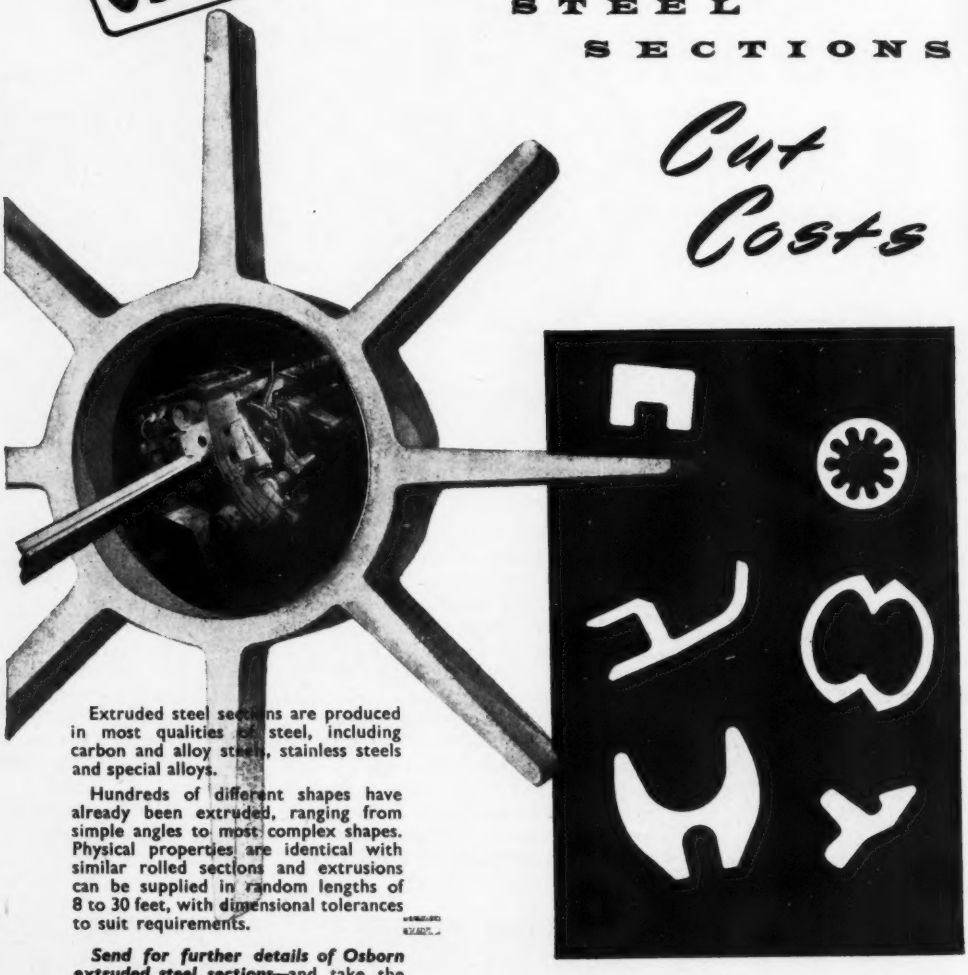

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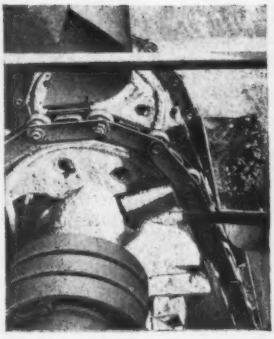

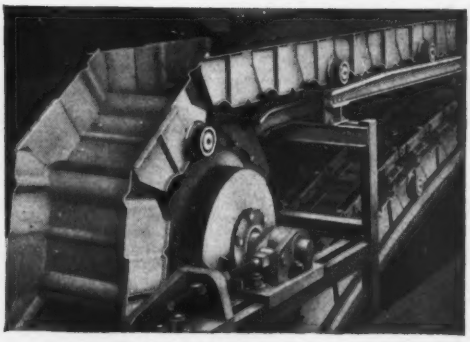

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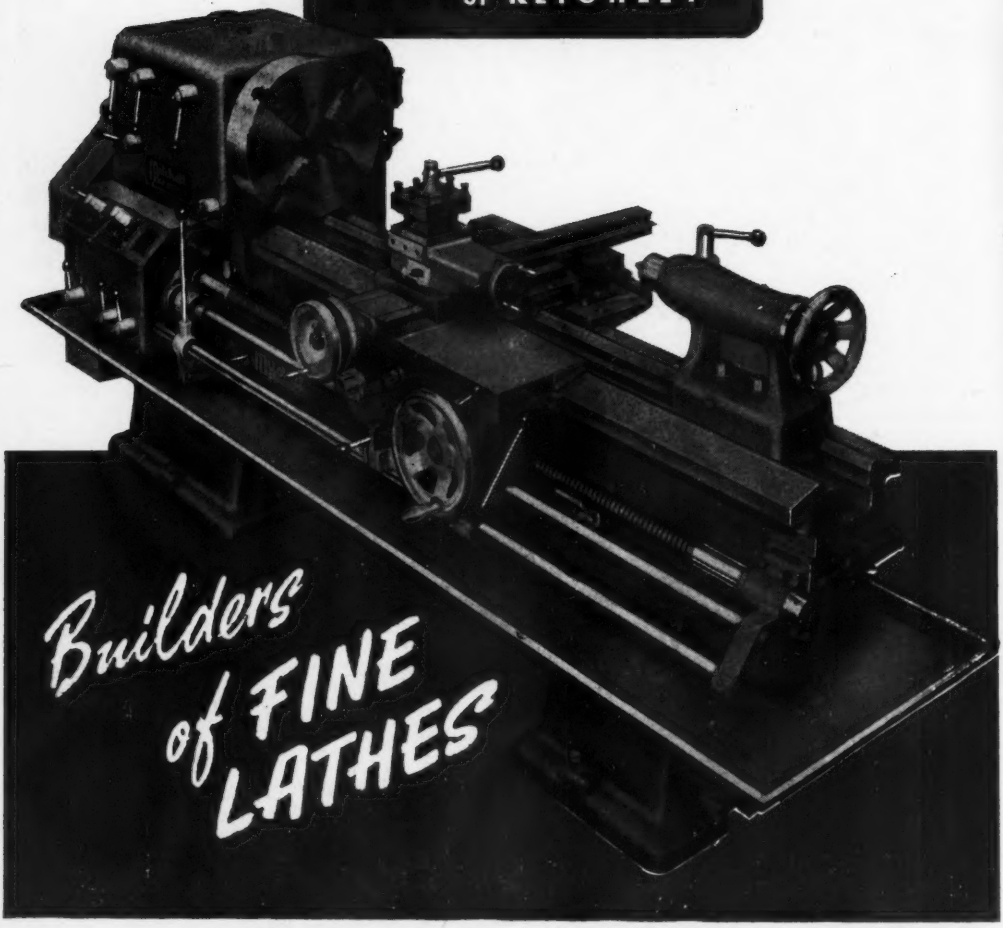

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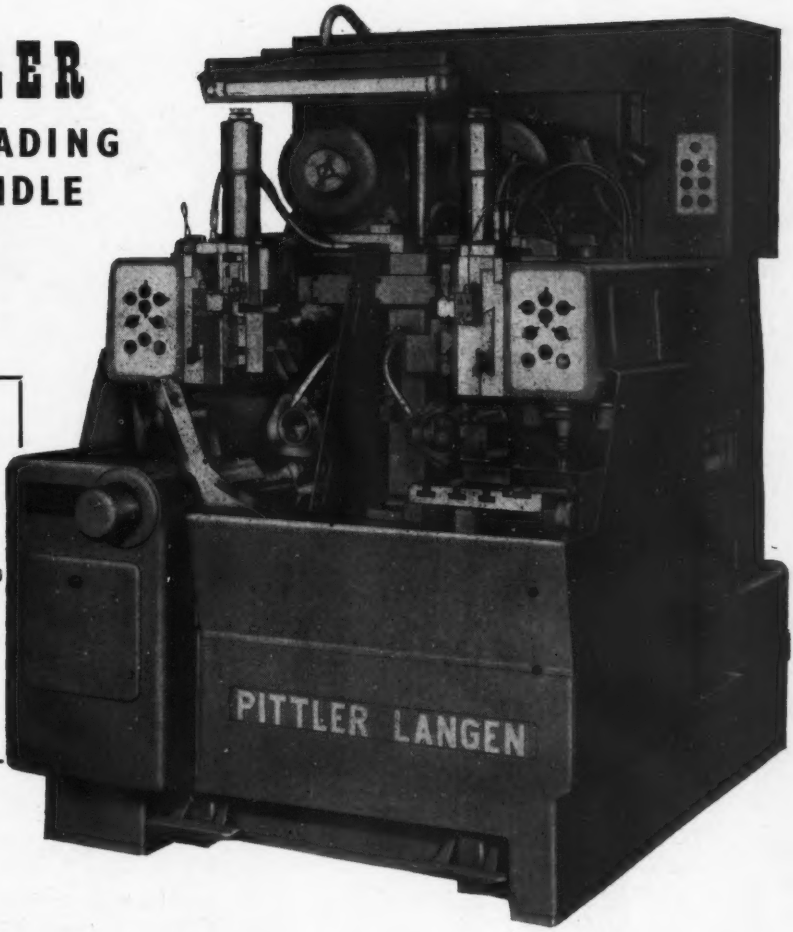

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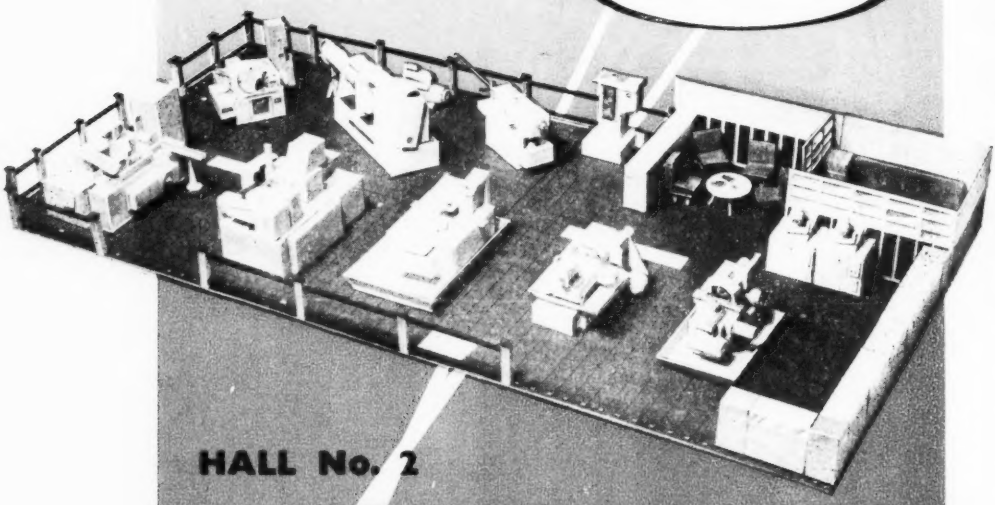

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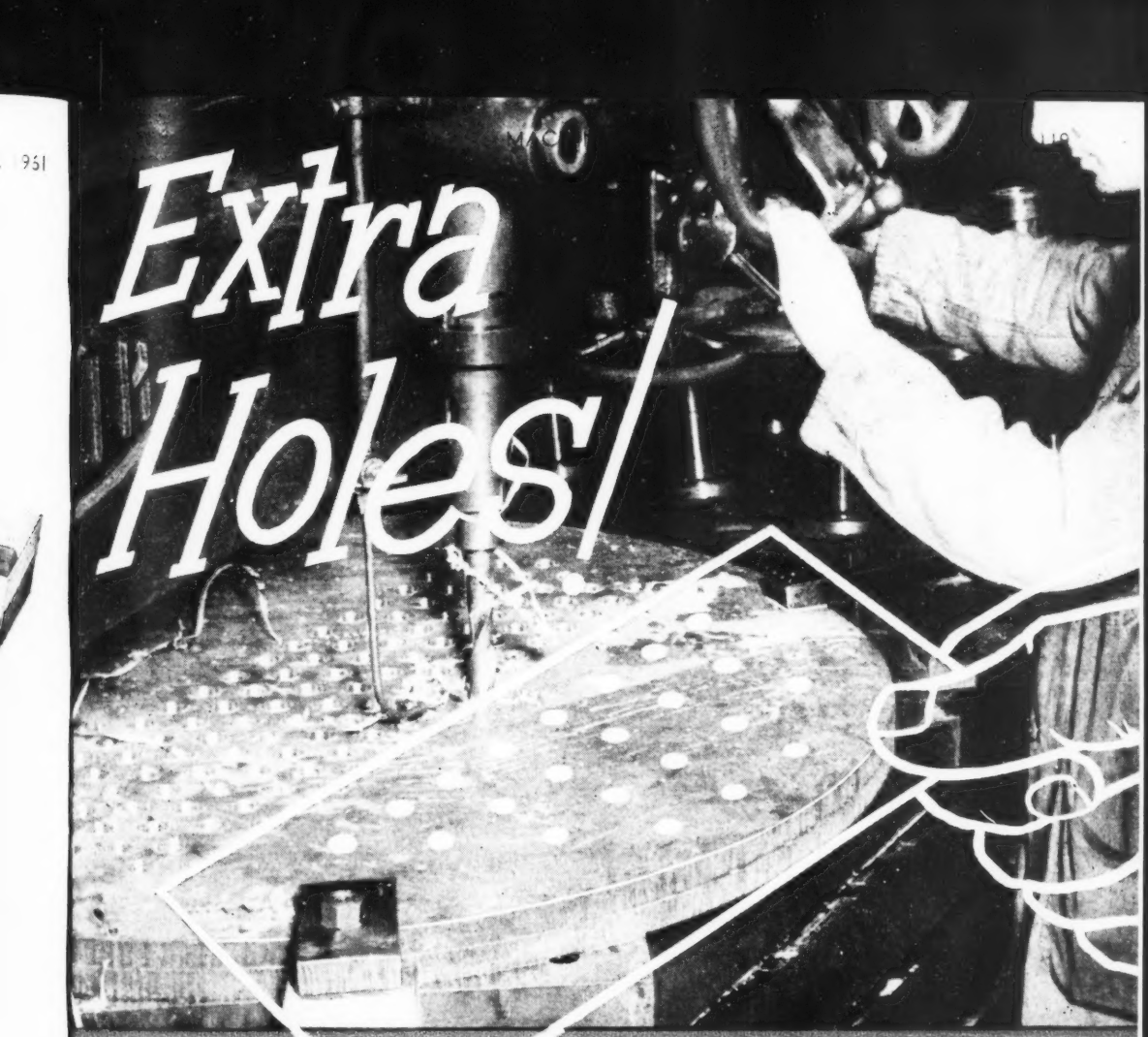

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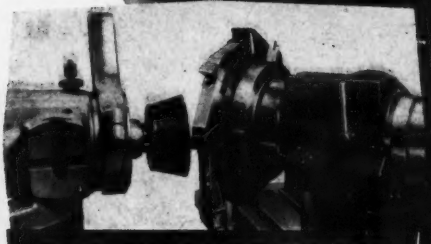

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Abstracts of Principal Articles

Making Petrol Dispensing Pumps P. 502

In this article, which is the third of a series, reference is made to the production of components for Gilbarco petrol pumps at the Crayford, Kent, works of Vickers-Armstrongs (Engineers), Ltd. After cast cam blanks for metering valves have been turned, drilled and reamed on a capstan lathe, the profiles are rough and semi-finish milled on Pratt & Whitney machines, followed by roller finishing on a converted milling machine. Centre castings for radial arm pivots are drilled on an Archdale pillar type machine with a multi-spindle head, and the fixture is arranged to slide in a channel to facilitate loading. The company has a large number of Britan repetition lathes, and a typical set-up for the production of a brass bearing bush on one of these machines is described. Finally, reference is made to the arrangements that have been provided for assembly of petrol pumps, also testing. (MACHINERY, 99—30/8/61.)

Some Engineering Applications of Nitrogen P. 509

Increasing use is being made of nitrogen for a wide variety of engineering applications, as a result of its special properties, and a number of examples are given in this article. For shrink fitting, for example, one mating part can be cooled with liquid nitrogen before being assembled to another, and with this arrangement the disadvantages associated with raising the temperature of one component are avoided. Other applications include: the de-gassing of non-ferrous metals; de-sulphurizing; re-carburizing; and the increasing of electrical conductivity of various metals. Liquid nitrogen is also being used as a trap for protecting vacuum systems, and for work in connection with the separation of isotopes. (MACHINERY, 99—30/8/61.)

Pressure Die Cast Aluminium Engine Blocks .. .. P. 511

In this article abstracted versions are given of two papers which were delivered at the 1961 SAE International Congress and Exposition of Automotive Engineering held in Detroit, Michigan, U.S.A., in January. The papers were concerned with the experiences of the Chrysler Corporation and American Motors in developing and putting into production new motor car engines incorporating pressure die cast aluminium cylinder blocks. Both types of engine are designed to incorporate integrally-cast cast-iron cylinder liners, and details are included of the experiences of both firms in designing the blocks and dies, and in certain aspects of the machining practices. Summaries are also given of the various advantages which have been gained as a result of the adoption of the new blocks. At American Motors it was decided to embark on fairly extensive production of a preliminary design of block, and to use the experience gained in the process to develop a second design, which is now in large-quantity production. (MACHINERY, 99—30/8/61.)

Index to Exhibits at the 7th European Machine Tool Exhibition Described on pp. 460 to 501 of this Issue

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EDITORIAL

The Electron Beam

Apart from important developments in established methods, many new techniques of metal working have been introduced in recent years, which have proved of considerable assistance in overcoming some of the numerous problems presented by certain of the materials that are now coming into use, and by the demands of designers for more exacting component forms and closer limits of accuracy. Some of these techniques, such as chemical milling, are, of course, merely adaptations of processes that have long been applied in different fields, whereas others represent radical innovations. Apart from chemical milling, the newer methods of metal removal which are being employed on an increasing scale include, for example, electrochemical and spark machining and ultrasonic erosion. In connection with metal forming, moreover, mention may be made of the high energy rate processes involving the use of explosives and electrical discharge, and the application of magnetic force. Ultrasonic vibration has also proved effective for certain welding operations, and the possibilities afforded by the high temperatures obtainable with arc plasma for welding, and more particularly for cutting a variety of metals, have previously been discussed in MACHINERY.

Among the latest techniques that have been made available to the production engineer are those based on the electron beam, which are already being used with success on a rapidly increasing scale, and appear to be of great potential value. In an article by Mr. K. H. Steigerwald published in a recent issue of *Zeiss Werkzeitschrift*, it is pointed out that whereas the heating effect produced when an electron beam impinges on an object has long been known, and is indeed a disadvantage in connection with many applications of electron radiation, it is only as a result of comparatively recent developments that it has been possible to turn it to practical account. Primarily it was as a result of work done in connection with the electron microscope that the methods of producing beams of the necessary energy and concentration were discovered, and the technology has now advanced to the point where "the electron beam, controlled by electron optics, provides a heat source with energy density, flexibility, and precision which far surpass those of previously known sources."

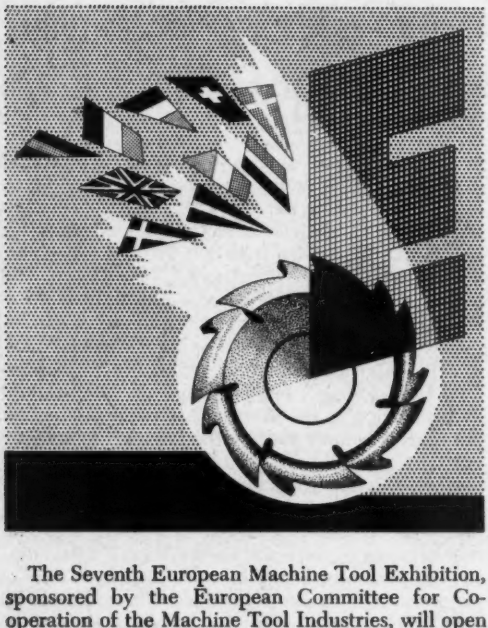
In support of this contention, the author of the article states that it is now possible to irradiate a surface with an energy density corresponding to 500 million watts per sq. cm., and to focus an electron beam with sufficiently high accuracy to melt a sharply defined spot of 0·00012 in. diameter on the surface of a metal plate. Because of the high energy densities obtainable, not only can any material be melted but also vaporized. Consequently, in addition to such operations as welding, brazing, and hardening, electron beams can be used for "drilling" and "milling" by vaporization.

Application of the electron beam for production purposes is complicated by the fact that operations must be carried out in a high vacuum. With modern vacuum equipment, however, the provision of the necessary conditions presents no particular problem. It may be noted moreover, that the requirements for electron bombardment automatically afford almost complete protection from atmospheric contamination. In this connection it has been stated that with the essential degree of vacuum, the level of atmospheric impurities is less than one part per million. For welding, which has been the principal application of the electron beam so far, there is the added advantage that the high temperature developed may vaporize some of the impurities in the metal which is fused, with the result that the weld is cleaner than the base material. It should also be pointed out that the absence of an electrode or arc in close proximity to the welding area avoids another possible source of contamination.

In the article to which reference was made above, Mr. Steigerwald has explained how, when the energy density exceeds a certain value, the beam will rapidly cut a fine channel through the work material. If such a beam is passed along the line of the contacting edges of two pieces that are to be butt welded together, these edges are quickly heated throughout their depth and there is a minimum spread of heat into the adjacent metal. As the beam moves, the thin layer of melted metal which surrounds it immediately solidifies to form a sound joint.

It will be understood that the electron beam is not a cheap source of heat, and for this reason its uses have so far been confined to operations where it offers some particular advantages. Mention has previously been made of the possibility of performing "milling" and "drilling" by metal

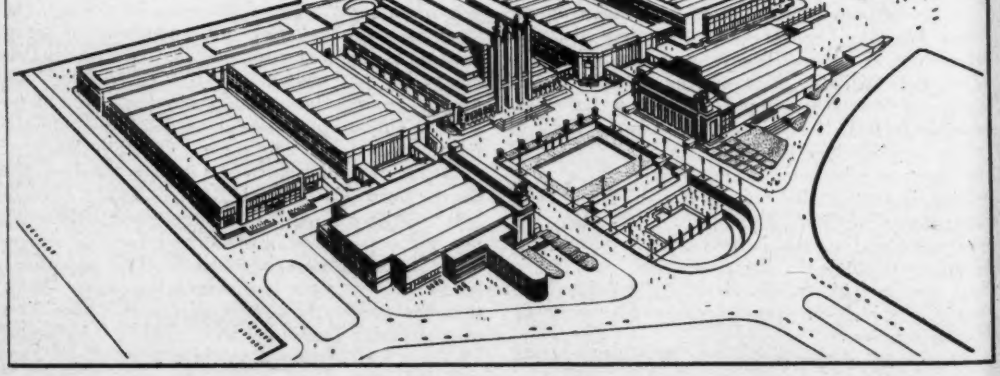
(*Continued on page* 519)



7th European

The Seventh European Machine Tool Exhibition, sponsored by the European Committee for Co-operation of the Machine Tool Industries, will open at the Palais du Centenaire, Brussels, on September 3, and will continue until September 12. A total of 762 machine tool builders and makers of allied equipment will take part, and whereas firms from Germany will predominate in number, important exhibits will also be staged by well-known companies from other European countries, including Great Britain, France, Switzerland, Italy, Sweden, Austria, Belgium and Denmark. The number of British firms participating will be 65. A floor space of about 495,000 sq. ft. will be occupied by stands, and some 4,000 machine tools, with a total weight of 15,000 tons, will be on view. In addition, exhibits will include small tools and production equipment, precision measuring instruments, welding equipment, testing machines, and equipment for heat treatment and surface treatment of metals.

The large number of firms participating affords an indication of the importance that continues to be attached to these European Machine Tool Exhibitions, and to the opportunities that they provide for the display and demonstration of machine tools and allied equipment to potential customers from all parts of the world. All classes of machine tools will be well represented, and although many builders will not be showing radically new designs, there is evidence of steady development and refinement to provide improved accuracy, greater reliability, and easier operation. Many machines will be shown with automatic work-handling equipment, and on others feed-back systems for the control of work-size, and the latest techniques for automatic



Machine Tool Exhibition-Brussels

FIRST ARTICLE

positioning and selection of operating cycles for milling, drilling and boring, will be demonstrated.

Details of some of the machine tools and equipment to be exhibited by various British and Continental companies are given in the following pages, and other noteworthy exhibits will be described in subsequent issues of MACHINERY.

ASQUITH 6-IN. RAM-TYPE HORIZONTAL MILLING AND BORING MACHINE

In Fig. 1 is seen the 6-in. ram-type horizontal milling and boring machine which has been introduced recently by the Asquith Machine Tool Corporation, Ltd., and is marketed by Drummond-Asquith, Ltd., King Edward House, New Street, Birmingham, 2.

Of rectangular section, the ram may be traversed horizontally in ways on the main slide, and carries a milling sleeve, which has a flanged nose and is mounted in special precision ball and roller bearings. The rear-most of these bearings has some axial freedom, and with this arrangement, the setting of the sleeve in relation to the work is unaffected by any rise in temperature during prolonged operation. The 6-in. diameter boring spindle is mounted within this sleeve, and can be traversed axially. Drive is taken from a variable-speed motor of either 30 or 50 h.p., through a mechanical speed-change system whereby steplessly-variable speeds from 1¼ to 500 r.p.m. can be obtained, and the arrangement enables the full power available to be employed at the spindle at speeds down to 24 or 50 r.p.m., depending on the size of the motor. Moreover, owing to the rigidity of the machine, the maximum power can be utilized for milling with the ram fully extended. Final drive is transmitted through a pinion and a precision ground single helical gear, which is mounted at the front of the ram.

Boring feeds for the ram and the spindle are normally obtained in a series of steps by means of a mechanical system in the slide, but a variable-speed motor can be incorporated, if required, to provide steplessly-variable feeds for the ram. Rapid traverse and "micro-setting" rates for both members are obtained by means of

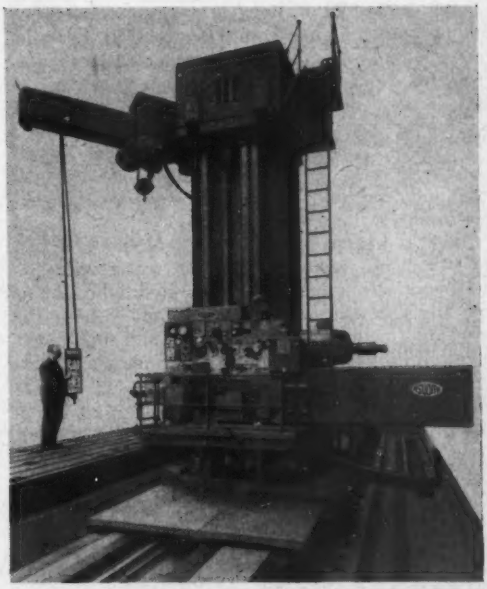


Fig. 1. Asquith 6-in., ram-type, horizontal milling and boring machine

separate motors, and as an extra item, gearing can be supplied to enable B.S.W. and metric screw threads to be cut. Various attachments are available for mounting on the nose of the ram, and drive for the right-angle milling, universal milling, and right-angle boring and facing units, for example, is taken from the spindle or the milling sleeve. For drilling or tapping units, for which high speeds are required, provision is made for taking drive from the pinion shaft in the main transmission, to enable a step-up ratio of 3:1 to be obtained. A facing head can also be supplied, for securing to the nose of the milling sleeve.

The main slide is counterbalanced by weights inside the column, and the latter is carried on a deep base, which may be traversed along ways on the plate-topped bed. Of wide and deep cross-

K.

section, the latter is formed by a number of sections, and special provision is made for setting them in accurate alignment. The machine can be supplied with traverses for these slides to suit requirements, and the standard version has horizontal and vertical movements of 8 and 20 ft., respectively, and a 6 ft. wide bed.

Movements of the main slide and the column are derived from separate motors, and drive is taken through gearboxes, each of which incorporates a system of magnetic clutches whereby milling feeds ranging from 0·02 to 60 in. per min. can be obtained, and the arrangement also provides for rapid traverse and micro-setting rates of 100 and 0·1 in. per min. Provision is made for controlling the motors simultaneously, by a steering system, to enable the spindle to be moved along any path in the vertical plane, and the resultant feed rate can be maintained at a predetermined value.

Rules and verniers are fitted, to facilitate setting the traversing members, and are read with the aid of optical equipment. Electro-hydraulic clamps for all slides are disengaged only when the associated member is to be moved, and the power-operated lubrication system for the machine incorporates interlocks, to prevent the engagement of a traversing movement until oil is circulating. Separate systems are provided for lubrication of the ram and the main slide, and incorporate radiators, to assist in the maintenance of constant temperature. The variable-speed motors are supplied by Ward-Leonard equipment, which is mounted in cabinets at the rear of the machine.

INDEX TYPE DG 12 AUTOMATIC

Index-Werke A.G., Hahn & Tessky, Esslingen am Neckar [Geo. Kingsbury & Co. (Machine Tools), Ltd., 54 Victoria Street, London, S.W.1], have introduced the DG 12 single-spindle automatic shown in Fig. 2. This machine has a normal capacity of 12 mm. (½ in.) diameter, but with the aid of special parts can be arranged to accept 16-mm. (⅝-in.) diameter bar. A range of spindle speeds is provided up to a maximum of 9,000 r.p.m., and a total of four speeds can be engaged under automatic control. Features of the machine include the drive system, whereby the use of chain sprockets or clutches on the spindle has been eliminated, also an arrangement for transmitting drive to various types of attachments from the headstock. There are four tool-slides, one each at the front and rear, and two inclined.

Particular attention has been paid to the reduction of idle time, and provision is made, by means of change gears, for short stroke operation of the

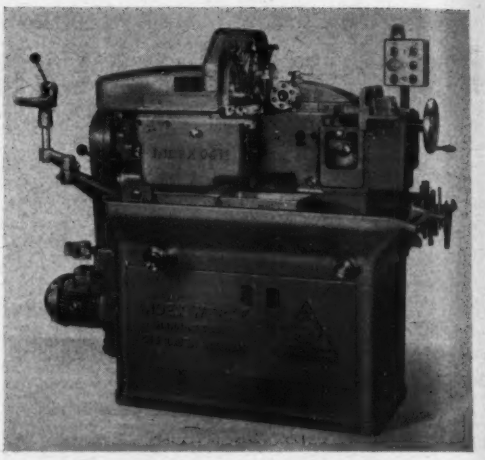


Fig. 2. The new Index type DG 12 single-spindle automatic

turret. The machine is of open-fronted construction, and has centralized lubrication. It is claimed that the grouping of controls on an easily accessible push-button box, and the provision of a geared reduction unit for manual-operation of the turret slide, greatly facilitate setting operations.

Demonstrations will be given on an Index type C 29 machine, with an 8-station turret, and other exhibits will include 18-mm. and 30-mm. C-type automatics, a representative machine from the B-type range with a hydraulic copy-turning attachment, and a type 25 automatic equipped with means for indexing and locating the work-spindle angularly. A typical short-cycle, high-speed set-up will be demonstrated on a type 12 machine, and a type B 60 F chucking automatic, suitable for machining castings, pressings, forgings and billets, will be equipped with an 8-station turret and an automatic magazine feeding attachment.

SALOMÉ SYNCHROMAT COPYING AND MULTI-TOOL LATHE

In Fig. 3 is shown the latest Synchromat programme-controlled automatic copying and multi-tool lathe built by Ets. Salomé Frères, 11-13 Rue Lavoisier, Nanterre (Seine), France (Dorman Machinery Sales, Ltd., Woodside Hill, Chalfont St. Peter, Bucks.). Upper and lower hydraulically-operated carriages are mounted on separate hardened steel guideways on the front face of the box-section bridge-type bed which is positioned at the rear, and this arrangement ensures that the working area is readily accessible for loading

and unloading, and facilitates swarf disposal. A hydraulically-operated copying unit and a transverse multi-tool slide may be mounted on the upper carriage, and a maximum of two multi-tool cross-slides, on the lower carriage. Alternatively, the copying unit may be replaced by a fourth multi-tool slide. All multi-tool slides are interchangeable, and they can be arranged in different combinations for performing a variety of turning, boring, facing and forming operations. Each slide is hydraulically-operated, and is fitted with three micrometer drums, two of which control the extent of the rapid power traverse movement to be imparted towards and away from the work axis, while the third provides adjustment for the point in the cycle at which cutting feed is to be applied. It is stated that slide movements can be controlled to an accuracy of 0·0004 in.

Copying units of three different designs are available, the first of which is intended for conventional single-pass profiling, and may be employed in conjunction with a template or a cylindrical master. The tracer unit at the rear is fitted with a tungsten carbide follower blade, and can be set at angles of 15, 30 or 45 deg., or to the vertical position, depending upon the shape of the workpiece to be copy-turned. Longitudinal and transverse feeds can be pre-set independently by separate knobs on the front of the unit. Intended for taking roughing and finishing cuts on the work at separate passes, the second copying unit incorporates a 2-position follower assembly which is hydraulically controlled between the passes.

The depth of cut for the finishing pass on the work, up to a maximum of 0·118 in., can be pre-set by means of a vernier. With the third unit, a maximum of four parallel roughing cuts can be taken on the work at successive passes, followed by two profile turning cuts under template control. The depths of cut for the roughing passes are controlled by stops adjustably mounted on a turret, which is automatically indexed at the end of the carriage traverse. For the copy-turning passes, different depths of cut, up to a maximum of 0·118 in., can be pre-selected by means of a vernier system.

With these copying units, cutting feed is maintained at a constant value over the entire workpiece profile, including shouldered portions. Automatic indexing holders for the templates can be provided for use with the 2-pass and multi-pass units, which enable different profiles to be copy-turned at successive cuts. In addition, automatic and semi-automatic indexing tool holders can be provided, to permit different tools to be brought into use for taking roughing and finishing cuts.

A maximum diameter of 16·9 in. can be swung over the bed-ways, of 11·8 in. over the carriages, and of 5·9 in. over the transverse slides when they are fully advanced, and a maximum of 30 or 47 in. can be held between the centres, depending upon the length of the bed. The upper and lower carriages have a maximum longitudinal movement of 27½ or 47·2 in., and the cross travel of the copying and multi-tool slides is 4·72 in. Steplessly-variable cutting feeds obtainable range from 0 to 47 in. per min., and rapid power traverse rates, from 15 to 18 ft. per min.

Driving motors of sizes from 10 to 25 h.p. can be provided to suit requirements, and spindle speeds in the range from 165 to 3,090 r.p.m. can be obtained by pick-off gears. Two spindle speeds in the ratio of 3 to 1, or four speeds in the ratio of 6 to 1, when a 2-speed motor is fitted, can be brought into use automatically during the working cycle by means of electro-magnetic clutches built into the headstock. Bored No. 6 Morse taper, the headstock spindle will take

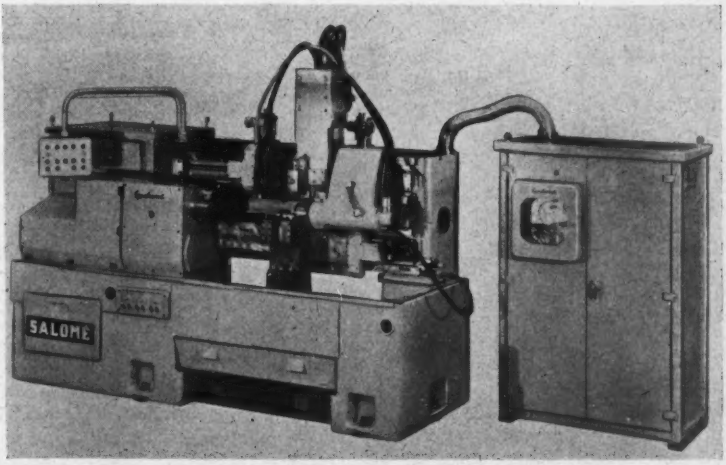


Fig. 3. The latest Salomé Synchromat programme-controlled copying and multi-tool lathe

K2

collets up to 2 in. capacity, and has a 6-in. diameter A1 Camlock nose.

A heavy-duty, hydraulically-operated tailstock is mounted on the upper bed-ways, and the barrel, which is bored No. 4 Morse taper, has a travel of 5·9 in.

Electrical equipment, also a "plug-board" which provides for programme control of the cutting cycles, is housed in a separate, floor-mounted cabinet. The motions of the machine members are shown by diagrams on the plug-board, and beside each diagram there is a double socket. Flexible leads, with double plugs at one end, are employed to connect the various sockets to suit the required machining programme. Sliding movements of the carriages are controlled by stops adjustably mounted on rods which have quick-release, bayonet-type end pieces. With this arrangement, the rod and stop assembly can be readily removed from the machine for setting, as a single unit if required. Micrometer adjustment is provided for accurately positioning the rods in an axial direction. For setting up, all motions can be controlled by push-buttons and switches, mounted on a swivel pendant unit above the headstock.

Fig. 4. Cincinnati Model ELR No. 207-12 universal dial-type milling machine equipped with an overhead spindle unit

CINCINNATI MILLING MACHINES

The exhibits of Cincinnati Milling Machines, Ltd., Kingsbury Road, Birmingham, 24, will include five knee-type and three bed-type milling machines, a Hydrotel die-sinking and profile milling machine, and a Model OM No. 2 tool and cutter grinder.

Model ELR No. 207-12, dial-type, milling machines, in universal and vertical designs, have recently been added to the company's range, and will be on view. The universal machine will be fitted with a 3-h.p. overhead spindle, comprising an overarm unit, with a built in motor and gearbox, as shown in Fig. 4. Starting, stopping, and reversing of the motor are controlled by push-buttons incorporated in a swivel-type pendant unit, and the gearbox gives eight spindle speeds which may range from 50 to 750, 75 to 1,125, 100 to 1,500, or 150 to 2,250 r.p.m. Provision is made for swivelling the cutter head in two planes on the end of the overarm, and minimum and maximum distances of 9 and 40½ in. are obtainable between the column face and the centre line of the cutter spindle.

The 59¾- by 12¼-in. work-table has longitudinal and transverse movements of 28 in., and 10 in., and the vertical movement of the knee is 19 in., the maximum distance obtainable between the centre line of the horizontal cutter spindle and the top surface of the table being 19⅞. Sixteen feeds from ½ to 60 in. per min. are available longitudinally and transversely, and from ¼ to 30 in. per min. vertically, the drive being taken from a 3-h.p. motor. Rapid power traverse is provided at the rate of 150 in. per min. in the horizontal directions, and 75 in. per min. vertically. The nut for the table traversing screw incorporates an arrangement for eliminating backlash, which is automatically disengaged when rapid power traverse is brought into use.

Drive to the horizontal cutter spindle is taken from a 7½-h.p. motor, and 22 speeds from 21 to 1,485 r.p.m. are obtainable. For selecting spindle speeds, a knob at the end of the operating lever for the clutch is pulled axially, which has the effect of turning the large-diameter indicator dial. As soon as the number on the dial which corresponds to the required spindle speed has been brought into line with a zero mark, the knob is released to complete the selection, and the clutch can then be engaged. As on other Cincinnati dial-type milling machines, the spindle nose is equipped with the company's Arbor-Loc quick-change cutter clamping unit.

In addition, a plain horizontal milling machine of similar design and capacity has been added to

the Cincinnati range. This machine, also the vertical type, can be arranged for operation on a variety of fully-automatic cycles, table feed, rapid power traverse and reversals being controlled by adjustable stops.

HyPowermatic bed-type production milling machines on view will be representative of a range which covers 42 sizes with work-tables from 18 by 60 up to 26 by 192 in. They are available in single and duplex forms with and without tracer control for copy milling. Steplessly-variable cutting feeds up to 150 in. per min. are obtainable on machines with table lengths not exceeding 144 in. and up to 100 in. per min. on the larger sizes, selection being made by means of a dial on the front of the bed. Rapid power traverse is provided at the rate of 300 in. per min. on the smaller machines and 200 in. per min. on the larger sizes. Drive to the table is taken from a hydraulic motor, which forms part of the Cincinnati Hydramech unit (see MACHINERY, 98/831—12/4/61), and a backlash eliminator is incorporated which is automatically brought into operation for climb milling. A variable feed unit is supplied as standard equipment on machines fitted with tracer control, and can be provided on others if required. A wide variety of automatic working cycles can be obtained by the use of stops adjustably-mounted on the table, and levers are conveniently grouped on the front of the bed for starting the cycle, also for controlling the spindle drive and the table movements independently, for setting up.

The Hydrotel type OE 16- by 30-in. die-sinking and profile milling machine to be shown will be fitted with the new Acratrace tracer unit, which is intended to be guided by hand in contact with a template or master for controlling the table and cross and vertical movements singly, or simultaneously in various combinations.

BERTHIEZ VERTICAL TURNING AND BORING MILLS

The type BM-125 single-column vertical turning and boring mill shown in Fig. 5 is fitted with a special grinding head, which has a maximum spindle travel of 47 in., and will be exhibited by Société Anonyme des Anciens Establissements Charles Berthiez, 5 Rue Montalivet, Paris, France (Soag Machine Tools, Ltd., 7 Juxon Street, London, S.E. 11), as representative of a new range. A maximum distance of 44 in. is obtainable between the lower edge of the cross-rail and the top surface of the 49-in. diameter work-table. Other machines in the range have 71- and 89-in. diameter tables.

Drive to the table is taken from a 50-h.p. motor, supplied by a Ward-Leonard set, through a 4-speed, hydraulically-operated gearbox. The steplessly-variable table speeds available range from 15 to 315 r.p.m., and since the motor and the gearbox are mounted with their axes vertical, the need for bevel gears in the drive system has been avoided. Provision is made for continuously varying the table speed to give a constant cutting speed, and the feed movements are obtained hydraulically. The table is mounted on a large-diameter ball thrust bearing, and a hydraulic clamping arrangement is provided for securing the cross-rail to the column ways. A 5-sided indexing tool-post is normally provided on the cross-rail tool-slide, and there is a 4-way tool-post on the side head. If required, a 2-directional automatic copying attachment can be provided, with either electronic or electro-magnetic control. The various motions of the machine are controlled by push-buttons built into a pendant unit. The machine is equipped with a special cooling system, whereby air is forced through various portions, including the main upright, to reduce temperature rise as a result of operating conditions.

With the Berthiez type BM-225 vertical turning

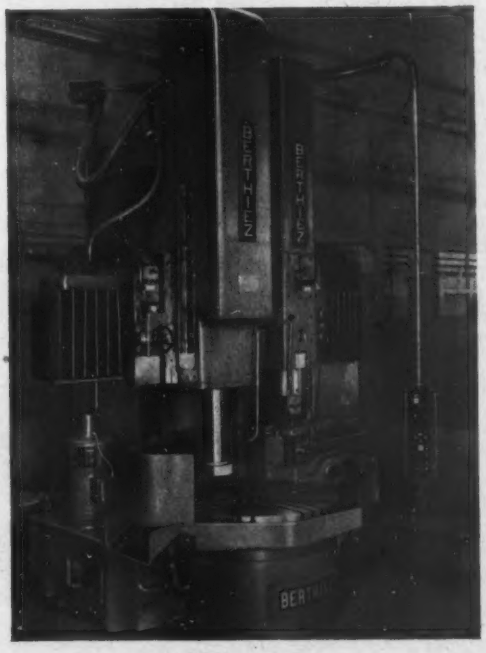


Fig. 5. The new Berthiez type BM-125 single-column vertical turning and boring mill is here shown fitted with a special grinding head

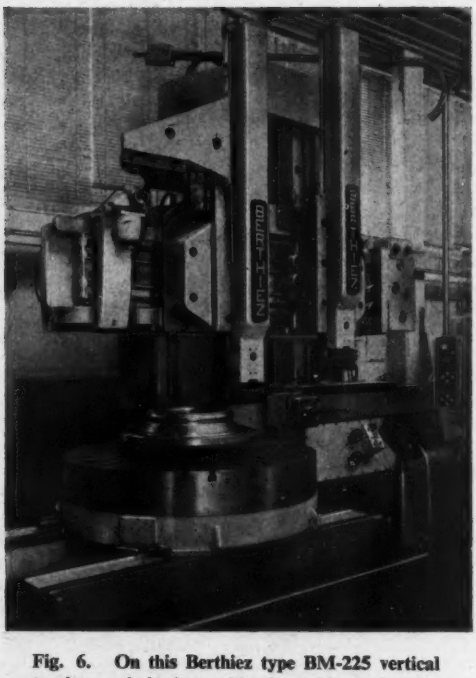


Fig. 6. On this Berthiez type BM-225 vertical turning and boring mill, the table and drive assembly can be traversed on bed-ways to give increased swing capacity, for accommodating work up to 178 in. diameter

and boring mill shown in Fig. 6, the housing for the 89-in. diameter work-table, and the associated driving motor and gearbox, can be adjusted horizontally on bed-ways to give increased swing capacity, and the maximum work diameter that can be handled is 178 in. The maximum distance obtainable between the cross-rail and the table is 79 in.

Drive is taken through a vertically-mounted gearbox from a 75-h.p. motor, supplied by a Ward-Leonard set, and the steplessly-variable table speeds obtainable may range from 0·8 to 80, 1 to 100, or 1·25 to 125 r.p.m. No bevel gears are incorporated in the drive, and for selecting different speed ranges, the pinion shafts in the gearbox are shifted hydraulically. An electrical braking system is provided for the table, which is supported hydrostatically on flat non-metallic guideways. There is a taper roller bearing and a ball thrust bearing for the spindle which are mounted in the same housing and pre-loaded. Hydraulic clamping arrangements are provided for securing the cross-rail to the column-ways and the table housing to the bed

The machine to be exhibited will be fitted with a taper turning and screwcutting attachment. Copying equipment of the electronically- or electro-magnetically controlled type can be provided, and an attachment is available which enables crankpins on crankshafts to be turned. If required, one of the tool-slides can be removed from the cross-rail, and replaced by a milling or grinding head, or by a special holder to take tools for boring cylinders and cylinder liners for diesel engines. The machine weighs approximately 33 tons.

On the type J vertical turning and boring mill, which will be shown fitted with electro-magnetic copying equipment, the distance between the top surface of the 40-in. diameter table and the non-adjustable cross-rail is 25½ in. Eighteen table speeds from 10 to 315 r.p.m. are provided, the drive being taken from a 25-h.p. motor through a vertically-mounted gearbox, arranged for hydraulic gear changing. A 5-sided indexing tool-post is mounted on the tool-slide for turning operations, and cutting feeds are obtained hydraulically. Handwheels for adjusting the tool-slide and saddle are mounted on a bracket, which can be moved on the traversing screw and shaft to a convenient operating position.

The type VG-100 rotary table vertical grinder to be shown (see MACHINERY, 95/457—9/9/59) was originally designed for handling races for large-diameter roller bearings, but may also be employed for grinding cylinder liners and rolls for tube mills, for instance. It has a 40-in. diameter work-table, for which steplessly-variable speeds from 2 to 50 r.p.m. are available, and is fitted with a side head. A second, swivel-type, grinding head may be traversed for the full length of the cross-rail, and the spindle may be reciprocated at steplessly-variable speeds from 3 to 79 in. per min., both these movements being hydraulically-powered. Provision is made for progressive reduction of the axial speed near the ends of the working stroke, and the spindles can be caused to dwell for a period variable from 1 to 20 sec., before reversal takes place. The grinding spindles will take wheels from 8 to 18 in. diameter, and are driven at speeds from 1,200 to 3,000 r.p.m. by motors of 8 and 15 h.p.

SYKES GEAR CUTTING AND SHAVING MACHINES

Recently introduced by W. E. Sykes, Ltd., Manor Works, Staines, Middlesex, the type 1B horizontal gear generator shown in Fig. 7, incorporates a number of new features to facilitate setting. Two independently-adjustable cutter heads are provided, which are mounted on a single

slide, and operated by an adjustable crank mechanism. The cutter slide normally has a working stroke of 2¾ in., but a movement of 3¾ in. can be provided, if required. Drive is taken from a 5-h.p. motor, and 5 working speeds, from 159 to 405 strokes per min., are usually available. If desired, a reduction gearbox can be fitted, and 8 operating speeds are then obtainable, which range from 79 to 405 strokes per min. Rotary feed is usually applied at the rate of 0·008 in. per stroke when a cutter with a pitch circle diameter of 4 in. is employed, but 13 additional feeds in the range from 0·004 to 0·018 in. per stroke can be obtained with the aid of pick-off gears.

In-feed is applied hydraulically in increments of 0·001 to 0·006 in., and rapid power traverse at the rate of 15 in. per min. is imparted to the saddle towards and away from the cutting position at the beginning and the end of the working cycle. The saddle is held in contact with an adjustable stop and locked hydraulically when cutting is in progress, and the centre distance between the cutter and the work is shown on an indicator, which gives direct readings to 0·001 in. By means of a selector switch, the machine can be set for taking one, two or three cuts on the work during the operating cycle.

A knob on an electric dial control unit, which is synchronized with the indexing worm for the work spindle, can be adjusted for setting the angle through which the work is to be turned, for example, when a gear segment is to be cut. When one segment has been cut, and the blank for the next component has been loaded, the direction of cutting may be reversed by operation of a lever, and the need for re-setting the machine is thus avoided. When any adjustments have been made following a trial cut on a gear, during setting up, the work can be advanced to the position required for cutting the teeth to the full depth, by pressing a "sizing" button.

A hand- or hydraulically-operated tailstock, also hydraulic work clamping equipment specially designed to suit particular components, can be supplied. Provision can be made for operation of the hydraulic tailstock, clamping and releasing of the work, and gear cutting, to be carried out automatically in sequence. In addition, magazine-type work-loading equipment can be provided, and the machine can then be operated on a fully-automatic continuous cycle. An attachment for handling cluster gears is available, which enables two gears on the same cluster, which may have different numbers of teeth and helix angles, to be cut simultaneously.

Spur gears from 36 to 2½ d.p., and helical gears up to 3 d.p., with right- or left-hand spiral angles up to 45 deg., can be cut on the machine, and blanks up to 17 in. diameter, with a maximum face width of 5 in. (for a double helical gear) can be handled. Another attachment is available which enables internal gears with pitch circle diameters up to 12 in. to be cut. The work spindle is bored 4⅝ in. diameter, to take gears with long integral shafts, and the entire spindle head can be adjusted on the saddle for a distance of 5 in., in an axial direction. A maximum distance of 26⅝ in. is obtainable between the end of the work spindle and the support for a hand-operated tailstock. The corresponding distance when a hydraulically-operated tailstock is fitted is 23⅝ in.

The machine will be shown fitted with loading rails for the work, and the attachment for cluster gears, and will be set up for cutting simultaneously, a helical gear and a spur synchromesh gear, on a semi-automatic cycle. The helical gear has 25 teeth of 3·6 module, 23 deg. 52 min. left-hand spiral angle, and a face width of 33 mm. (1·299 in.), and the spur gear, a face width of 18·4 mm. (0·724 in.), and 28 teeth. Three cuts will be taken on the work during the cycle, and a cutter speed

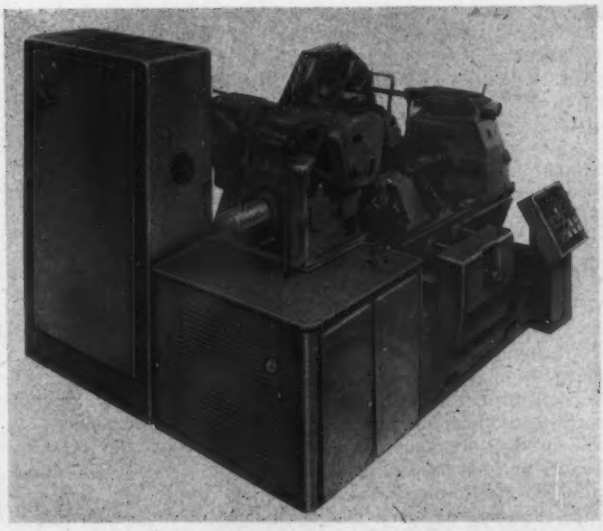


Fig. 7. The new Sykes type 1B horizontal gear generator

of 230 strokes per min., and a feed of 0·016 in. per stroke will be employed. The floor-to-floor time will be 11 min.

Following the cutting operation, the helical gear will be shaved on the latest type VS 12A universal machine, which incorporates an arrangement of improved design for setting the up-feed movement of the knee. There is a drum at the front of the machine which is fitted with four sets of adjustable stops for operating micro-switches. Stops in the first and third sets control the extent of the knee movement in each direction, and those in the fourth set serve to prevent over-running. The stops in the second set determine the amount and number of the up-feed movements of the knee during the shaving cycle. Feed can be applied to the knee in various increments down to 0·001 in., and the stops are set with reference to ¼-in. wide divisions on the drum, each of which represents a knee movement of 0·0005 in.

From the motor, drive to the feed screw is transmitted by precision gearing, and an electromagnetic clutch and a separate brake are provided, which ensure accurate positioning of the knee. When rapid power traverse is applied to the knee in either direction, the drum is not rotated, so that the settings of the stops are not disturbed. The machine will handle gears up to 12 in. diameter, with pitches up to 4 d.p., and can be supplied for operation on a semi-automatic cycle if required. An attachment is available for shaving crowned gears.

A type V10B-Sykomatic vertical gear generator will be shown set up for cutting a helical gear with 13 teeth and a face width of 0·6 in., for a motor car layshaft. The Sykomatic machine comprises, essentially, a type V10B gear generator (see MACHINERY, 96/1524—22/6/60) fitted with an indexing carrier, which serves to bring workpiece blanks, in turn, to the cutting position, so that the operation is fully automatic.

STUHLMANN HYDRAULIC KEYSEATING MACHINES

The vertical keyseating machine shown in Fig. 8, is representative of a range built by Richard Stuhlmann & Son, Cologne-Braunsfeld, West Germany [Selson Machine Tool Co., Ltd., Sunbeam Road, London, N.W.10]. Known as the type NZH100/650, it is hydraulically operated, and will cut keyways from ⅛ to 4 in. wide in bores from ⅜ to 20 in. diameter. The maximum stroke is 26 in., and steplessly-variable cutting speeds up to 33 ft. per min. are available, the return speed being 66 ft. per min. A maximum cutting force of 9 tons can be exerted.

Fig. 8. Stuhlmann type NZH100/650 hydraulically-operated keyseating machine

There is no limit to the diameter of the workpiece that can be machined, but the weight must not exceed 10 tons. The machine works on the draw-cut principle, and the cutter is guided throughout the full length of stroke. Workpieces are clamped between stepped bushes in the bore, which ensure correct centring of the grooves, and setting is facilitated by an inching switch. An increment of feed is applied to the tool at each stroke by means of a wedge bar which is pulled downwards automatically. At the beginning of the return stroke, the tool is retracted by the action of a cam which moves the cutter feed bar.

The work table can be swivelled up to 10 deg., for cutting keyways in taper bores, and for producing multiple grooves, an index plate can be supplied which has either 24 or 120 ground notches and a detent plunger. Provision is made at the centre of the plate for insertion of a pilot bush to locate the workpiece. Special equipment available includes a 22- by 26-in. combined swivelling and centring table which can be swivelled through 10 deg., and moved, in any direction, on ball bearings, through a distance of 1 in. There is also a coolant unit and a cutter grinding attachment.

Mechanically-driven keyseaters in the range include the type NZ320S/50, which will cut keyways from ¾ to 2 in. wide in bores from ½ to 16 in. diameter. Workpieces weighing up to 6 tons are accommodated, and the maximum length of cut is 12 in. The arrangement of the cutter head is similar to that of the hydraulically-operated machine.

BUHLER TYPE H 800 COLD-CHAMBER DIE CASTING MACHINE

The type H 800 cold-chamber die casting machine made by Buhler Brothers, Uzwil, Switzerland [Buhler Brothers, Wood House, Cockfosters, Barnet, Herts.], is shown in Fig. 9. It is designed to apply a locking force of 800 tons and is suitable for the production of zinc, magnesium, and aluminium die castings, the maximum weight for aluminium being 28 lb. The cast steel platens provide a space measuring 33 by 37 in., between the 7-in. diameter tie bars, and minimum and maximum die "heights" of 16 and 43 in. can be accommodated. A long opening stroke permits deep castings to be produced, but means are provided for shortening the stroke to reduce the cycle time when shallow components are being made.

Die locking is effected by a hydraulically-operated double-toggle mechanism which obviates the risk of damage from overload, and can rapidly be adjusted to suit the die height. Three of the four tie bars of the machine can be pushed back, hydraulically, to facilitate the handling of heavy, bulky tools, and the tie bar nuts are fitted with graduated rings so that they can be tightened to provide an evenly-distributed locking force. The speed of die movement is steplessly variable, and the movement can be interrupted at any position of the stroke by an emergency stop switch.

Speed, pressure and duration of each of the three injection stages can be adjusted independently, to suit the part to be cast, and the alloy. The injection cylinder will apply a maximum force of 90 tons, and it can be adjusted hydraulically, a choice of a centre and two "below-centre" positions being thus afforded. Also, it is so arranged as to provide ample space for the use of an automatic ladling unit, if required.

Drive is taken from a motor of 53 h.p., and the electrical controls are housed in a separate cabinet remote from the machine to protect them from vibration. There is provision for selection, by push-buttons, of nine different cycle programmes. A programme may include the operation of four groups of core-drawing cylinders and the hydraulic ejector, and all movements are interlocked. The maximum operating speed is 360 cycles per hour, and the machine weighs about 37 tons.

O.M.T. ROUNDNESS MEASURING MACHINE

Made by Optical Measuring Tools, Ltd., 142 Bridge Road, Maidenhead, Berks.—a member company of the Newall Group—the roundness measuring machine shown in Fig. 10 will be exhibited on the stand of the Newall Engineering Co., Ltd., Old Fletton, Peterborough.

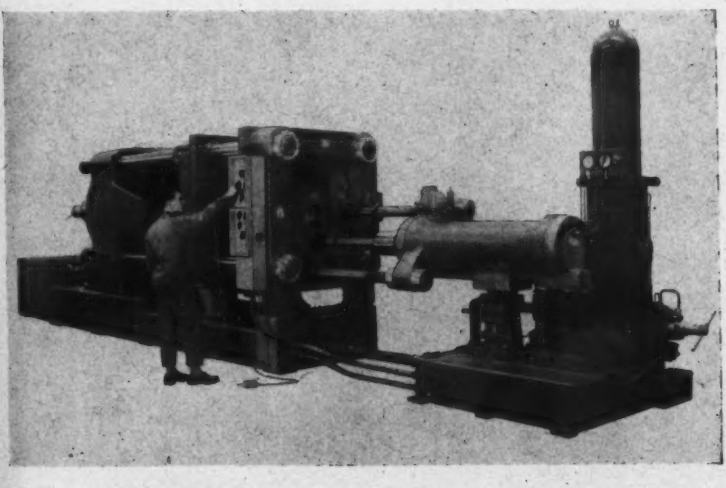


Fig. 9. Buhler type H 800 cold-chamber die casting machine

With this instrument, bores from ¾ to 6 in., and external diameters from ⅛ to 6 in. can be checked to within 0·00001 in. for roundness. The design is based on prototype equipment developed by the National Engineering Laboratory (see MACHINERY, 96/1648—29/6/60), and to provide the necessary high degree of concentricity with low frictional force, the spindle runs in an air bearing, which is the subject of a patent application made by The National Research Development Corporation. The working pressure

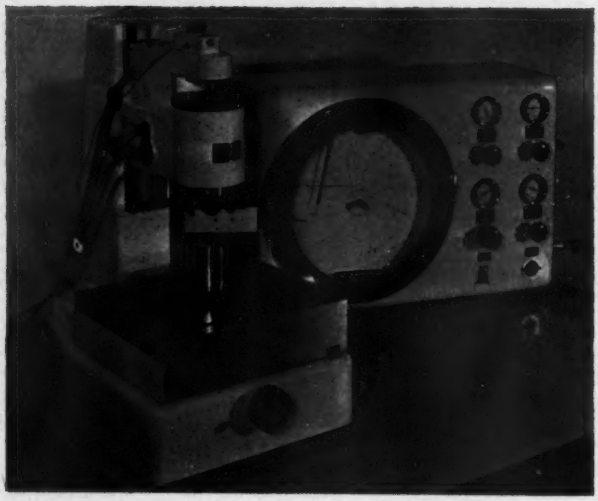


Fig. 10. O.M.T. roundness measuring machine

for this bearing is 60 lb. per sq. in., and it is claimed that the concentricity is within 0·000005 in.

When gauging is in progress, the spindle is rotated at a speed of 1 r.p.m. by a motor drive, and deflection of the ball-ended stylus pin resulting from any out-of-roundness of the work, causes a signal to be produced by a pneumatic pick-up in the gauging head, which is operated under a pressure of 4 lb. per sq. in. The signal is amplified and fed to a recording unit, whereby errors in roundness are indicated on a circular chart by a capillary pen mechanism. An inkless recording unit is, however, being developed. Adjustment is provided which enables readings from a number of workpieces to be recorded on a single chart, and a magnification of 5,000 or 10,000 × can be selected by a knob on top of the bearing assembly.

The slide which carries the gauging head can be adjusted on the column ways for a maximum distance of 6 in. by a handwheel through worm gearing, and may be clamped in the required position. Screw adjustment through a distance of 1 in. on either side of the central position is provided in the longitudinal and transverse directions for the 12- by 10-in. table, which has a number of concentric circles marked on the top surface to facilitate positioning components to be checked. If required, an adjustable vee block can be provided for mounting on the table for locating workpieces. Alternatively, an auxiliary table can be supplied, which is supported on the main table and can be adjusted for level to permit workpieces to be set accurately parallel with the spindle for the gauging head. With another arrangement, the entire measuring head may be mounted on an O.M.T. toolmakers' microscope.

The spindle for the gauging head may be readily disconnected from the driving motor and then rotated by hand for setting up. The stylus pin normally provided is about 1 in. long, but other lengths can be supplied to suit requirements. Stylus ends are available in steel or sapphire and in shapes other than spherical, if desired. The distance between the centre line of the spindle and the face of the column is 6·78 in., and the space occupied by the measuring instrument is 14⅝ by 21½ in., and by the recording unit, 28½ by 17½ in.

An O.M.T. 30-in. diameter rotary table which incorporates the E.M.I. numerically-controlled positioning system will also be displayed. This table will support loads weighing up to 1,200 lb., and settings can be made to an accuracy of ±3 sec. of arc on a fully- or semi-automatic cycle under control of punched tape, or individually by means of dials on the control unit. (For full details, see MACHINERY, 96/1628—29/6/60.)

Prominence will be given to the Newall Contimatic 1520 precision milling and boring machine incorporating the A.E.I. Numeritrol system (MACHINERY, 99/77—12/7/61), which provides for continuous numerical control in the longitudinal, transverse and vertical directions from magnetic tape, as required for profile milling 3-dimensional shapes.

FORTUNA-WERKE PRECISION GRINDING MACHINES

Fortuna-Werke, Spezialmaschinenfabrik, A.G., Stuttgart-Bad Cannstatt, West Germany (Vaughan Associates, Ltd., 4 Queen Street, Curzon Street, London, W.1), will demonstrate, for the first time, a special heavy-duty machine, shown in Fig. 11, for plunge grinding the end journal of a crankshaft using multiple grinding wheels. This machine, designated type KAE 500/1000 AR, is equipped with a swivelling wheel-head to take wheels of a maximum diameter of 36 in., which are dressed to an angular form to provide for grinding the shoulder faces in addition to the journal surfaces.

Apart from the loading and unloading of the work, the grinding cycle is fully automatic. After the crankshaft has been placed on work supports it is automatically positioned in the longitudinal direction by a push-button controlled, electro-hydraulic attachment fitted with an electrical feeler unit. During the grinding cycle, the machine is controlled by a Finitor electric gauging head which determines the final size of the work.

The multiple wheel set is automatically trued by a Finiform profile truing device with a diamond holder slide inclined at an angle of 20 deg. A timing unit is provided to register the grinding operations between successive wheel dressings, and to initiate the truing cycle automatically by means of a pre-selector unit. There is automatic compensation for reduction of the wheel diameters by truing, so that, at the end of the rapid approach movement, the grinding wheels are brought into the same initial position relative to the work.

A Finibalanz attachment which has been developed for cylindrical grinding machines is also incorporated, which enables the wheel to be accurately balanced while mounted on the spindle. The subject of a patent application, this device consists of a mechanical balancing system within the grinding wheel spindle, which operates in conjunction with an electronic measuring and indicator unit. The unbalance normally existing in every grinding wheel produces mechanical vibrations which are picked up by a feeler apparatus and transformed into electrical a.c. voltage fluctuations. An electrical filter ensures that only those vibrations are amplified and registered which are due to unbalance of the wheel at a particular service speed. Any out-of-balance indicated can readily be eliminated by the adjustment of two knobs on the right-hand side of the wheel-head.

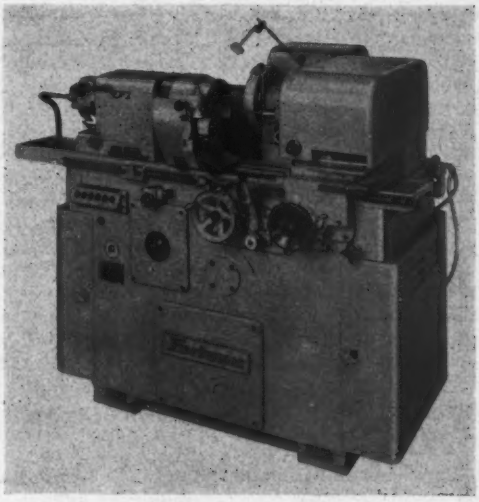


Fig. 12. Fortuna type SIP V internal and face grinding machine for operations on workpieces with very small bores

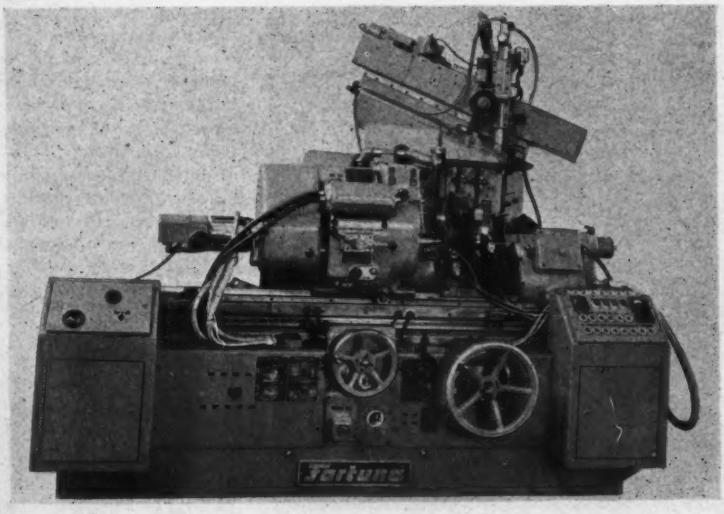


Fig. 11. Fortuna type KAE 500/1000 AR plunge grinding machine for crankshaft journals

Another new development to which attention will be drawn is the Zyklon coolant filter which provides for the collection, during coolant circulation, of all grinding swarf and sludge in a filter sack, which can readily be emptied or replaced.

Shown in Fig. 12 is the type SIP V internal and face grinding machine for finishing very small bores. It is equipped with a high-frequency grinding spindle which runs at 120,000 r.p.m., and the

spindle speeds of the work-head are steplessly-variable from 160 to 3,600 r.p.m., by regulating the armature voltage of a rectifier set through a magnetic amplifier.

Reference may also be made to the type AFD 450/630 AP polygon grinding machine. The motion of the wheel-head to produce the required work form is controlled by an eccentric, the throw of which is steplessly variable from zero to 8 mm. (0·315 in.). Synchronization of the rotary motion of the work and an elliptical motion of the wheel is obtained electrically, and adjustable transmission ratios determine whether a circular eccentric, or a 2-lobe, 3-lobe, or 4-lobe polygon profile is produced. This machine can also be employed for plain cylindrical grinding.

GIDDINGS & LEWIS-FRASER IMPROVED ENDOMATIC MACHINE

An improved version of the type MC Endomatic facing and centring machine, built by Giddings & Lewis-Fraser, Ltd., Arbroath, Scotland, is shown in Fig. 13. Independent control is now provided for each head, and it is stated that this feature permits more accurate control of the feed motions and results in increased cutter life. Single lever directional control for the movements of the heads facilitates setting-up, and attention has been paid to ease of maintenance, particularly in connection with the hydraulic equipment.

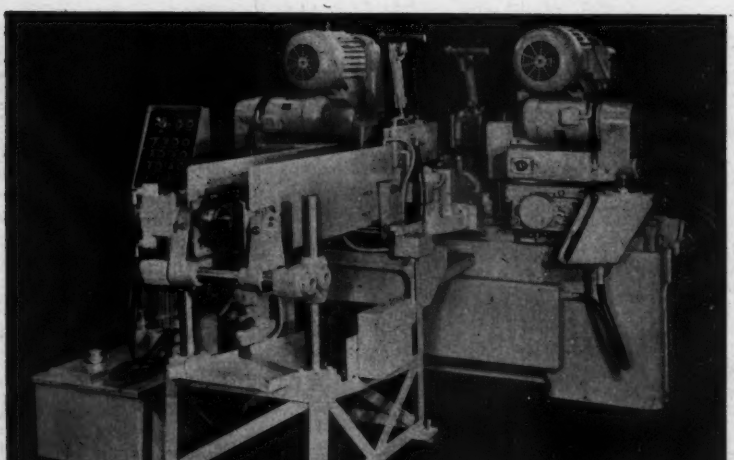


Fig. 13. The latest version of the Giddings & Lewis-Fraser Endomatic facing and centring machine

A new design of swinging-arm loading and unloading device, which operates in conjunction with input and output conveyors is provided, and is stated to be suitable for handling awkward-shaped components in addition to those of simple form. The work-handling units, and the corresponding conveyors—which can be of the shuttle or indexing type—are self-contained and independent. It is stated that the shuttle type conveyor eliminates the need for the storage banks normally provided with link-line installations. The machine can be supplied in a range of sizes, up to a maximum capacity of 132 in. between the faces of the cutters.

The company will also be showing the type DB machine, which is also double-ended and is intended for drilling, boring, facing, reaming, chamfering, turning and centring operations. Each head is arranged for independent control of feed stroke, feed rate, and rapid return motion.

Horizontal boring, milling and drilling machines made by the company will be represented by the Giddings & Lewis Hybormill, which was described in MACHINERY, 96/1512—22/6/60, in connection with the International Machine Tool Exhibition.

GRAFFENSTADEN FLOOR-TYPE HORIZONTAL MILLING AND BORING MACHINE

The AMC. 163 floor-type horizontal milling and boring machine (Fig. 14), recently introduced by the German firm of Graffenstaden (Acbars, Ltd., 331-333 Walworth Road, London, S.E.17), has a flamed-hardened octagonal spindle ram, which can be traversed axially for a maximum distance of 49·2 in. A maximum spindle head movement of 98·4, 118, or 129·8 in. is obtainable, depending on the height of the column, and the column saddle has a travel of 157·5 in. on guideways on the bed, the overall width of which is 85 in. Twenty-four feeds are available, which range from 0·24 to 49·2 in. per min. for milling, and from 0·00047 to 0·1 in. per spindle rev. for drilling and boring. Rapid power traverses at the rate of 78·7 in. per min. are provided. The

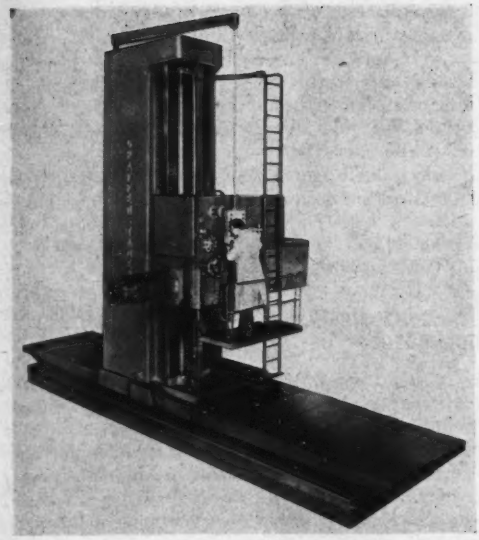


Fig. 14. Graffenstaden AMC. 163 floor-type horizontal milling and boring machine

spindle head and column can also be traversed at the rate of 11·8 in. per min. for coarse adjustment, and 0·06 in. per min. for final accurate positioning. Settings are normally made with the aid of vernier scales in conjunction with an adjustable telescope on the spindle head, but optical measuring equipment can be provided if required.

Eighteen speeds, ranging from 10 to 500 r.p.m., are obtainable for the 6·3-in. diameter spindle, which is bored to take a No. 60 U.S. standard taper shank. Remote control for starting, stopping, reversing, and inching the driving motors, tightening and releasing the hydraulically-operated clamps for the sliding members, and engaging and disengaging feed and rapid power traverse motions, is afforded by push-buttons and switches built into a pendant unit suspended from a swivel arm on top of the column. Facilities for selecting spindle speeds and feeds and for hand control of the spindle and sliding motions, are provided on the headstock.

A vertical milling head and a universal head are available for mounting on the spindle ram. A floor plate can be supplied, also rotary work-tables in two sizes, which have top surfaces of 63 by 78·7 and 78·7 by 118 in., and can be hand or power traversed on base guideways, for maximum distances of 39·4 and 59 in. There are 8 power feeds for each table from 0·106 to 3·307 in. per min., also rapid power traverse at the rate of 27·2 in. per min., the drive being taken from a 6-h.p. motor. The table can be rotated by hand, or at a speed of 0·8 r.p.m. by a separate 6-h.p. motor drive.

NEW PACERA DRILLING AND TAPPING MACHINES

Drilling machines in the M8 series, which has been added recently to the Pacera range built by W. J. Meddings, Ltd., Ipswich Road, Trading Estate, Slough, Bucks., have capacity for drilling up to ⅝ in. diameter in mild steel, and can be supplied with a floor stand or for bench mounting, as seen in Fig. 15. Air-hydraulic feed equipment is available, and, if required, the drilling head can be supplied with a slide base only, for mounting horizontally on a special-purpose machine.

The drilling head can be adjusted vertically by hand through a distance of 17 in., and is clamped by means of a lever at the right-hand side. Bored No. 2 Morse taper, the splined spindle has an axial travel of 5 in., and the bearing at the nose end is of the angular contact type. A total of five spindle speeds ranging from either 500 to 4,000 or 1,000 to 8,000 r.p.m. is obtainable, and drive is taken from a ½-h.p. motor through a flat, nylon-impregnated belt which runs on balanced pulleys.

The throat depth is 12⅝ in., and a maximum distance of 19 in. can be obtained between the nose of the spindle and the 19¾- by 17-in. surface of the work-table. This surface is normally plain, but T-slots can be provided if desired.

Designated M.F.7, a floor-mounted vertical drilling machine, with capacity for drilling up to 1¼ in. diameter in mild steel, has also been introduced by the company. On this machine, drive to the spindle is taken from a 2-h.p. motor through a system which provides steplessly-variable speeds in two ranges, from 170 to 470 and 520 to 1,400 r.p.m. If required, electrical equipment can be supplied for reversing drive to the spindle, for

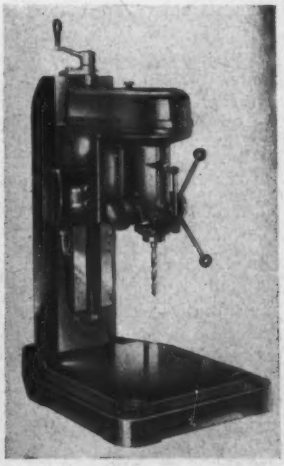


Fig. 15. A bench drilling machine from the Pacera M 8 series

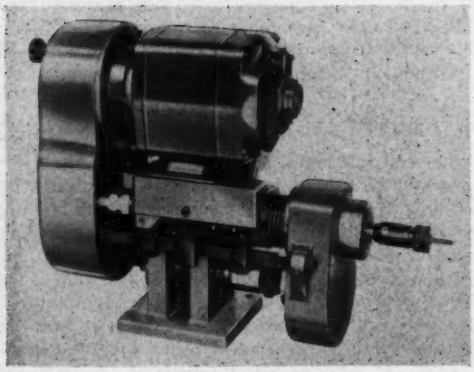


Fig. 16. Pacera type H.T.H. leadscrew-controlled horizontal tapping head

tapping. Bored No. 3 Morse taper, the spindle has an axial travel of 6 in., and power feeds of 0·004, 0·008, and 0·012 in. per rev. are obtainable. The main gears in the head are hardened and ground, and the feed mechanism incorporates an automatic clutch, to prevent damage due to overloading.

The throat depth is 11 7/16 in., and the 19- by 15-in. work-table can be hand adjusted on the column, to maximum and minimum distances of 25¾ and 10¾ in. from the spindle nose. To enable deflection under the cutting load to be minimized, a telescopic jack is attached to the under-side of the table. Coolant equipment can be supplied.

In Fig. 16 is shown the type H.T.H., leadscrew-controlled, horizontal tapping unit, which has capacity for cutting threads up to 7/16 in. diameter in mild steel. Working rates range up to 10 reversals per min., and units may be arranged for operation manually or automatically, either singly or in multiple set-ups. A motor of ½ or ¾ h.p. is provided, for use on 3- or single-phase electrical supplies, respectively, and four speeds from 285 to 1,000 r.p.m. are obtainable for the spindle, which is fitted with an overload clutch. A chuck for gripping taps from either 6 B.A. to ¼ in. diameter or ¼ to ½ in. diameter can be employed, and the spindle has an axial traverse of 2½ in. The distance from the spindle axis to the base is 5⅝ in., and the overall dimensions of the unit are 21 by 7 by 14¾ in. high. The electrical control equipment is housed in a separate cabinet.

Other exhibits will include three examples of rotary and in-line transfer-type drilling and tapping machines, also pitch-controlled tapping machines for bench and floor mounting, and drilling machines and heads with air-hydraulic feeds.

WALDRICH-SIEGEN NUMEROMAT NUMERICALLY-CONTROLLED ROLL-PROFILING LATHE

In Fig. 17 is shown the Numeromat numerically-controlled roll-profiling lathe built by H. A. Waldrich, G.m.b.H., Siegen, West Germany (Alfred Herbert, Ltd., Red Lane, Coventry). With a centre height of 26 in., this machine will swing diameters up to 45 in. over the cross-slide, and workpieces up to 200 in. long and with a maximum weight of 20 tons can be held between centres. Main drive is taken from a 100-h.p. motor, and the spindle speeds and the longitudinal and transverse feeds can be steplessly varied from 1·5 to 90 r.p.m. and 0·01 to 20 in. per min. Heavy roughing work can be performed, and the cutting tool is mounted in the company's "Lamellated" tool post, which permits high rates of in-feed to be employed for plunge-cutting without risk of chatter or tool breakage.

For profile turning under numerical control, the machine is operated in conjunction with equip-

Fig. 17. Waldrich-Siegen Numeromat numerically-controlled roll-profiling lathe

ment made by AEG, Berlin, and the cutting tool can be moved in a path within an area measuring 200 in. long and 16 in. wide. Dimensional data for the co-ordinates of the ends of straight and arcuate portions of the required path, also for the centres of the arcs, are supplied by an 8-channel punched tape, which is prepared with the aid of a conventional teletype machine, and the form between successive points is interpolated by the equipment, the slides being moved with an accuracy of the order of 0·0001 in. The tape also provides for the selection of spindle speeds and feed rates, for stopping the slides to permit plunge cuts to be taken, and for visible signals to indicate the stages at which tool changes are to be made, for example.

The control equipment incorporates a system whereby the datum point for the profile to be cut can be altered manually in either direction, and with this arrangement, considerable reduction can be effected in the amount of metal removed when reconditioning rolls on which wear has occurred principally on one flank of each groove. A unit may also be employed whereby the optimum adjustment is determined and applied automatically. To obviate the risk of producing incorrect work, information may be duplicated on the tape and continuously checked by a comparator system. Also, to permit the detection of any errors of the profile shape which may be introduced during preparation of the tape, a unit has been developed whereby the cutter path may be recorded on a paper strip before machining is begun.

Electrical copying equipment is also provided on the machine, and when it is in use, in-feed movements are applied by way of quick-acting electrical clutches, which are operated by signals transmitted from the tracer head, through a transistorized amplifier. Flat templates are employed, which are mounted below the saddle, and they need not be hardened, in view of the low pressure exerted by the tracer stylus.

WADKIN TYPE L.H.R. ROTARY-TABLE MILLING MACHINE

Designated type L.H.R., the rotary-table vertical milling machine shown in Fig. 18 has recently been added to the range built by Wadkin, Ltd., Green Lane Works, Leicester, and is intended for continuous operation in the production of light-alloy components.

A table of 48 or 54 in. diameter can be provided, and can normally be driven at 1, ¾, and ½ r.p.m., to give peripheral speeds of 150, 100, and 50 in. per min. with the smaller unit. Alternatively, equipment can be incorporated whereby the peripheral speed can be steplessly varied from 10 to 100 in. per min. Workpieces are usually clamped manually in the fixtures mounted on the table, but provision can be made, if required, for the use of air-operated clamps, to which compressed air is supplied from the centre of the table. With the latter arrangement, the clamps are controlled by means of a cam bar.

Fig. 18. Wadkin type L.H.R. rotary-table milling machine for light-alloy components

Speeds up to 4,000 r.p.m. are obtainable for the milling spindle, which is driven by a 2-speed, 6-h.p. motor through 2-step pulleys. Mounted on precision slides, the milling head can be adjusted vertically through a distance of 12 in., and there are separate handwheels for coarse and fine setting. In addition, a horizontal adjustment of 12 in. is provided, for positioning the head in relation to the centre of the table. If desired, the machine can be equipped with an extraction system, as illustrated, for removing swarf from the working area.

Other exhibits on this company's stand will comprise the type L.C.6 articulated arm routing machine, which was displayed at the Olympia Machine Tool Exhibition last year and described in MACHINERY, 96/1616—29/6/60, and the type T.C.D.1 tape-controlled co-ordinate drilling machine. Details of the latter were given in MACHINERY, 95/275—19/8/59, but it may be

noted that the machine on view will be equipped with a spindle head that incorporates a 6-position, indexing tool turret. This unit has capacity for drilling up to $\frac{3}{8}$ in. diameter in mild steel, and tapping up to $\frac{5}{8}$ in. B.S.W., and spindle speeds from 116 to 3,000 r.p.m. can be obtained. The stroke length for each turret station is 6 in., and the operating cycle comprises rapid approach, feed and rapid return. Depths are controlled by means of stops on a turret which is indexed in unison with the tool turret.

PELTZER & EHLERS HOTMASTER TRANSFER-TYPE HOT PRESS

The Hotmaster 3-station transfer-type hot press built by Maschinenfabrik Peltzer & Ehlers (Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2) is intended primarily for the production of hollow steel parts, from bars which have previously been heated to a temperature of approximately 1,200 deg. C., and it is stated that the finished components have clean surfaces and a notable absence of "flash". Machines of various sizes are available, and the range includes the types GH 30, GH 40, and GH 50, with capacities for producing parts with maximum external dimensions from $1\frac{3}{32}$ in. diameter by $1\frac{3}{16}$ in. long to $3\frac{1}{16}$ in. diameter by $2\frac{3}{8}$ in. long, and bores up to $1\frac{3}{16}$ and $2\frac{3}{8}$ in. diameter, respectively, at speeds ranging from 40 and 100 per min. according to the size of the press and the nature of the component. An example from the range is shown in Fig. 19, and the company's exhibits will include the smaller type GH 20, which has a maximum output of 120 parts per min.

Upper and lower pairs of rollers provide for feeding the bar to an accurately-adjustable stop, and during the movement, a large amount of the surface scale is removed. The upper rolls can be raised by an air-operated system, to facilitate loading a fresh bar, and the latter then serves to move forward the remainder of the previous bar. Short ends are removed from the machine by an electro-magnetic device without the need for interrupting the operating cycle. In readiness for shearing, which is performed by a blade mounted on an individual slide, the bar is thrust by a shoe against a fixed cut-off bush, and after completion of the operation, the slug is transferred by the shearing blade to the first tooling station, where it is aligned with the die by a loading arrangement. A semi-forming operation is carried out here, and at the beginning of the forward movement of the ram for this stage, the shear blade returns to the original position. When the next slug is cut off, a gripper, which travels parallel with the shearing slide, transfers the workpiece to the second station, and positions it in the die, for forming. During the next forward stroke of the ram, the part is thrust into this die by the associated punch, and forming is then carried out by a plunger that is moved through the punch by means of an independent slide, motion being imparted by way of an adjustable connecting link. With this arrangement, the length of the period of contact with the hot work is kept to a minimum. The maximum time for cooling is thus afforded, and long tool life is obtained.

The workpiece is stripped against the punch when the plunger is retracted, and is subsequently pushed from the die by an ejector and then carried downwards to the final station by a vertical transfer slide, for piercing. At this station, the scrap is pushed through the die, and passes down a chute out of the machine, and when the ram returns, the finished component is withdrawn from the transfer slide and then removed from the punch by a stripper block, and discharged.

The nitride-hardened main slides are mounted in special bronze guides, and are operated by hardened and ground cams, motion being transmitted through levers and shafts. A second set of cams provides for operating auxiliary equipment such

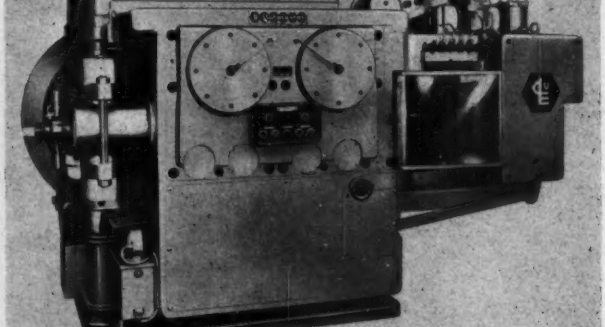


Fig. 19. Peltzer & Ehlers Hotmaster transfer-type hot press

as the shearing blade and the ejectors, and motion is imparted to slides which are also nitrided. To facilitate changing over for the production of a fresh component, the final forming and piercing dies and the transfer slide are arranged in a single unit, which is accurately located in a recess and retained by two bolts. Separate oil and grease systems provide for automatically lubricating all the moving parts, and fluid for cooling the tools is supplied at an adjustable rate by a centralized system.

Electro-pneumatic clutch and brake units are incorporated in the main transmission, and duplicated controls at the front and the rear of the machine are employed in conjunction with a selector switch that may be set for inching or single-stroke working, and continuous running at the pre-determined speed. In addition, provision is made for the machine to be run at a slow rate. Limit switches are fitted, to stop the machine in the event of a breakdown or the failure of a tool, and the source of the trouble is indicated by a series of warning lamps mounted on a control cabinet.

J & S TYPE 761 MICROMATIC HYDROHONER

The type 761 Micromatic Hydrohoner shown in Fig. 20 has recently been introduced by A. A. Jones & Shipman, Ltd., Leicester, in conjunction with their associates, the Micromatic Hone Corporation, Detroit, Michigan, U.S.A., and is specifically intended for honing to very close tolerances. Claimed to be particularly suitable for bores which have a high length to diameter ratio, the machine has a 15-in. stroke and at this setting bores up to 1½ in. diameter can be honed. Larger diameter bores can be handled, however, if a shorter stroke is employed.

Housed in a hydraulically-operated, reciprocating quill, the spindle unit is driven from a 2-h.p. motor and steplessly variable speeds from 175 to 940 r.p.m. are provided. The reciprocating speed is also steplessly-variable, from zero to 65 ft. per min. Provision is made for expanding the stone holder at a constant rate during honing, and it is arranged to collapse immediately the hole has been brought to the required size. The hydraulic system incorporates a double pump, which provides a high pressure for the reciprocating motion, and a low pressure for expanding the stone holder.

Microsize automatic sizing equipment is fitted, and it is stated that bores of successive workpieces can be held to the same diameter within 0·0003 in., or less. When the stones are worn beyond a pre-set amount, a special indicator ensures that the machine is shut down, and it is arranged that it cannot be re-started until new stones have been fitted. Normally, the machine is supplied with a paper-roll coolant clarifier, but other types of equipment can be provided if required.

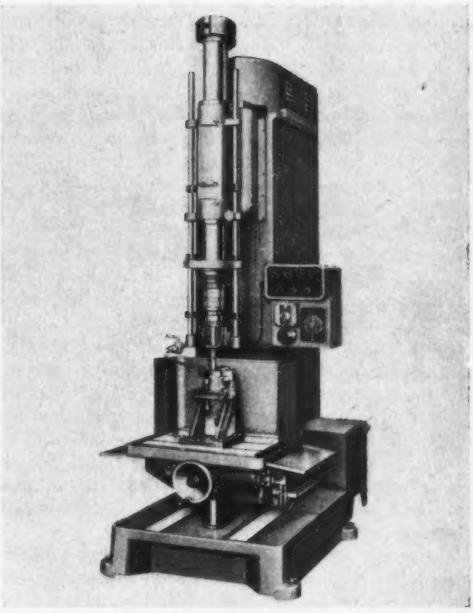


Fig. 20. The new Jones & Shipman type 761 Micromatic Hydrohoner

KEARNS HORIZONTAL BORING MACHINES

In MACHINERY, 96/1510—22/6/60, was published a description of the type 451 P Optimetric horizontal boring, surfacing, milling, drilling and tapping machine, as an example from the latest range introduced by H. W. Kearns & Co., Ltd., Broadheath, Manchester. The largest machine in this range is the type 721 P, which will be shown. An important feature is the combination of an axially-moving spindle with the company's patented facing head, the latter being an integral part of the machine, and the arrangement is such that the spindle can be rotated independently of, or in unison with, the facing head.

The type 721 P machine will face diameters up to 24 in., and 24 speeds are provided for the facing head, ranging from 6 to 297 r.p.m. Of 3 in. diameter, the spindle is bored No. 5 Morse and has 27 speeds, from 6 to 1,160 r.p.m. At

any one setting it can be traversed by power over a distance of 1 ft. 6 in., and this movement can be doubled if two settings are made. If required, the spindle can be equipped with the company's patented tool-holding device, whereby boring bars and mandrels, for example, are held in position by a bayonet-type catch and a powerful spring, and are released hydraulically. When this device is incorporated, the spindle is provided with a No. 40 non-stick taper bore at the nose end. The work-table measures 4 ft. by 4 ft., and a 3-ft. by 6-ft. revolving table is provided.

The company's well-established range of S-type machines has recently been augmented by the introduction of the Optimetric high-speed spindle-type shown in the Fig. 21, which will accommodate workpieces up to 1 ft. cube and is intended for boring holes to close limits of accuracy for centre distance, and to a high surface finish. The spindle head slides on ways on the front face of the column, which has a deep-cored throat, and with this arrangement the thrust of the cut is taken centrally between the guideways.

Measuring 18 in. square, the revolving table is carried on a compound table which is arranged for power traverse on the bed. Feed movements of the compound table on the bed are derived from a ¼-h.p. Kopp unit, and are steplessly-variable between $\frac{3}{16}$ and 4 in. per min. Mounted in precision ball and roller bearings, the spindle is driven by a 2-h.p. motor, through toothed belts and a gearbox, which provides speeds within the range 50 to 2,000 r.p.m. By means of the company's patented Optimetric optical measuring system, the vertical position of the spindle head on the column, also the transverse position of the table, can be set within ±0·00025 in.

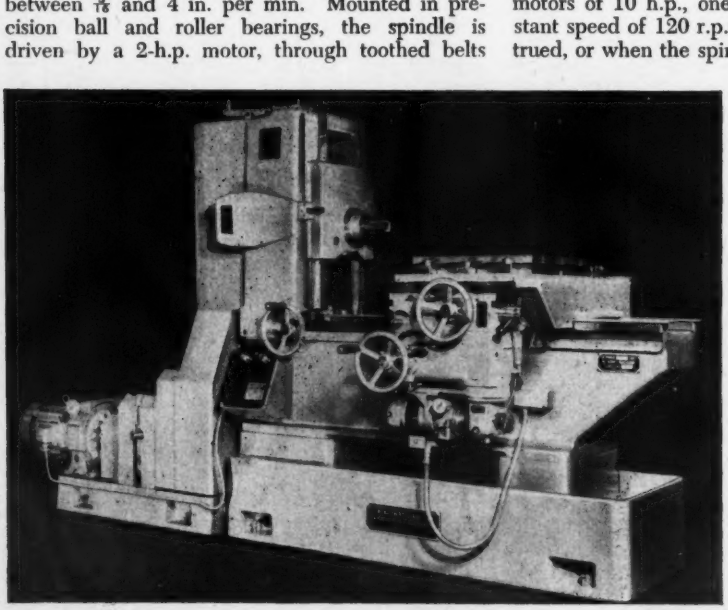


Fig. 21. The latest Kearns S-type Optimetric high-speed horizontal tool-room boring machine

LIDKOPINGS CENTRELESS GRINDERS

The type 5B centreless grinder made by Lidkopings Mekaniska Verkstads A-B, Lidkoping, Sweden (Drummond-Asquith, Ltd., King Edward House, New Street, Birmingham 2), which is shown in Fig. 22, is intended for through-feed grinding only, and replaces the former type 5A. It has a capacity from 0·2 in. to 13 in. diameter for light-work, to 10 in. for heavy work, and to 8 in. for bars or tubes.

Grinding wheels up to 26 in. diameter by 14 in. face width can be fitted, and the driving motor may range from 60 to 100 h.p. The drive is transmitted by multiple V-belts, and the spindle pulley is relieved of belt pull. A feature of the design is that two double-row cylindrical roller bearings are provided at each side of both the grinding and control wheels.

Drive to the 16-in. diameter control wheel spindle is provided by two coupled asynchronous motors of 10 h.p., one of which maintains a constant speed of 120 r.p.m., when the wheel is being trued, or when the spindle runs without load. The other motor is controlled by a magnetic amplifier to maintain a constant selected grinding speed in the steplessly-variable range from 16 to 80 r.p.m. Final transmission to the spindle is by worm gearing which runs in an oil bath.

Both the grinding and control wheel-heads can be adjusted relative to the workpiece by hand-wheels fitted with dials graduated in divisions of 0·0004 in. In addition, push-button adjustment of the grinding head can be obtained during grinding, normally in increments of 0·00008 in., 0·00016 in., 0·00024 in., or 0·00032 in. If required, however, a feed device can be sup-

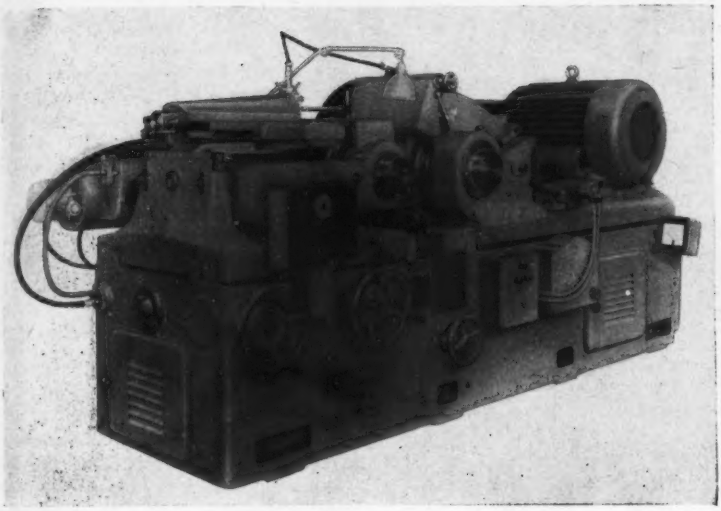


Fig. 22. Lidkopings type 5B centreless grinder

plied to apply coarser-increments, from 0·0002 in. to 0·0008 in. The device can readily be connected to an automatic sizing attachment. Both wheels are provided with hydraulically-operated truing devices which can be arranged to operate on an automatic cycle.

The spindle bearings and grinding wheel pulley bearings are automatically lubricated by oil mist. Pressure oil lubrication is provided for the guideways for the heads, the vertical adjustment gear for the work rest, the feed screws, and all bearings inside the machine frame. Two coolant nozzles, one on top of the grinding wheel, and the other one below, ensure efficient cooling of the work during grinding. Separate nozzles are provided for the truing diamonds. Equipment available for the machine includes automatic and semi-automatic power-driven roller tables for feeding heavy bars and tubes.

Another exhibit will be the No. 2B/SP small precision centreless grinder which is arranged for advance and withdrawal of the grinding wheel under push-button control. The wheel can be positioned to an accuracy of 0·00002 in.

EXHIBITS OF DAVID BROWN INDUSTRIES, LTD.

The No. 6 hob sharpening machine shown in Fig. 23 has recently been introduced by David Brown Industries, Ltd., Machine Tool Division, Manchester. A number of hobs up to 6 in. diameter, which have a maximum total length of 12 in., and from 4 to 36 gashes, can be sharpened on this machine at one setting if required. The table has a working stroke of 17 in., and is traversed hydraulically at speeds which are steplessly variable up to 25 ft. per min. Settings for lead angle can be made to an accuracy of 1 min. of arc by means of a sine bar arrangement at the front of the machine.

Indexing is effected hydraulically, and an interlocking system is incorporated which prevents the table traverse motion from being started until the work spindle has been brought to rest. Feed can be applied by hand, or automatically, at either end of the table travel, in increments down to 0·0005 in. A wheel dressing attachment is fitted.

The type UPH 30 ultra-precision gear hobbing machine, which will be shown, has a capacity for cutting gears up to 30 in. diameter, and incorporates an electronic feed-back system whereby continuous adjustment is provided to compensate for any errors in the table indexing drive. Details of the feed-back system were given in MACHINERY, 96/1307—8/6/60. Gears up to 10 in. diameter can be cut on the Hydrax No. 10 production hobbing machine, which will be fitted with automatic work loading equipment. When helical gears are to be cut on the Hydrax machine, the hob slide is swivelled to the helix angle of the hob, and the saddle is traversed in the direction of the helix angle of the gear. With this arrangement, the need for differential mechanisms and lead screws and cams is avoided, and the machine can be readily set up. Moreover, there is a reduction in the hob travel as compared with that required for conventional methods, and "relative" hob shift is obtained. A hob shift movement is imparted automatically at the end of each cutting cycle.

A type S.12.H production gear shaving machine, which will also be shown fitted with automatic work loading equipment, will handle spur and helical gears up to 12 in. diameter. For shaving gears with medium face widths, and involute splines, the machine can be set up so that the

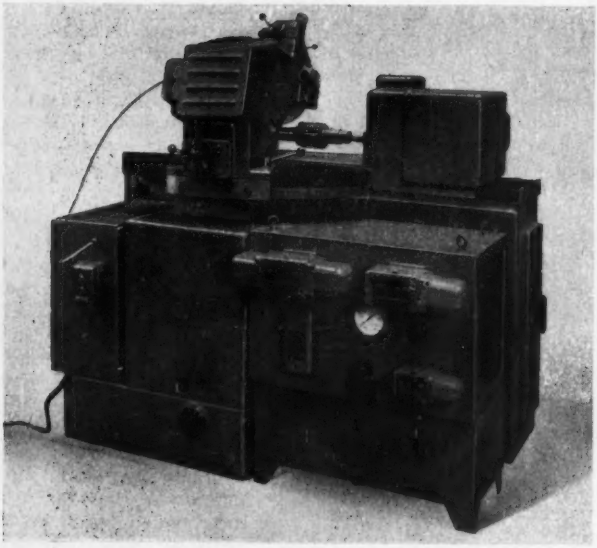


Fig. 23. The new David Brown No. 6 hob sharpening machine

cutter is traversed in a direction parallel with the work axis, or, alternatively, at an angle to the work axis. With the latter method there is a reduction in the length of cutter travel required, and wear is uniformly distributed. With a third method of operation, which may be employed for shaving narrow gears and for gears close to shoulders, the cutter is traversed in a direction at 90 deg. to the work axis.

Another exhibit will be the David Brown series 18 combined involute and helix angle measuring machine (MACHINERY, 98/495—1/3/61), which has a capacity for gears with base circle diameters ranging from ⅝ to 18 in.

HEALD TYPE 221 UNIVERSAL BORE-MATIC, AND OB SERIES HIGH-SPEED GRINDING HEAD

Heald Machines, Ltd., Kingsbury Road, Birmingham, 24, will include among their exhibits the type 221 universal Bore-Matic shown in Fig. 24, which has recently been added to the British-built range. This machine has a single boring head, which may be a No. 212, 216 or 218 unit, mounted centrally on a swivel plate over the bridge, to permit setting to an angle in the horizontal plane, for carrying out taper boring or turning operations.

In the drive to the boring head there is a steplessly-variable unit to provide a wide range of speeds, which are selected by a convenient control knob and indicated on a tachometer mounted in the guard. Speeds up to 4,000 r.p.m. can be provided for the No. 212 head, and up to 2,500 r.p.m. for the ball bearing, and 1,500 r.p.m. for the roller bearing No. 216 head. The No. 218 head, which is equipped with roller bearings for the spindle, can be run at a maximum speed of 1,000 r.p.m.

When fitted with standard Bore-Matic attachments such as the hydraulic cross-slide or cross-feed units, the capabilities of the machine are extended to include facing and grooving operations during the automatic cycle. At the Exhibition, this machine will be equipped with a 3-jaw toggle chuck to hold a cast iron demonstration piece of 8 in. diameter, and multiple tools will be mounted on a hydraulic cross-slide for performing boring, counter-boring, facing and chamfering operations in an automatic sequence.

Other machines on view will include a type 271 Size-Matic automatic internal grinder for bores up to .5½ in. diameter, and a type 171 Gage-Matic automatic internal grinder for bores up to 2 in.

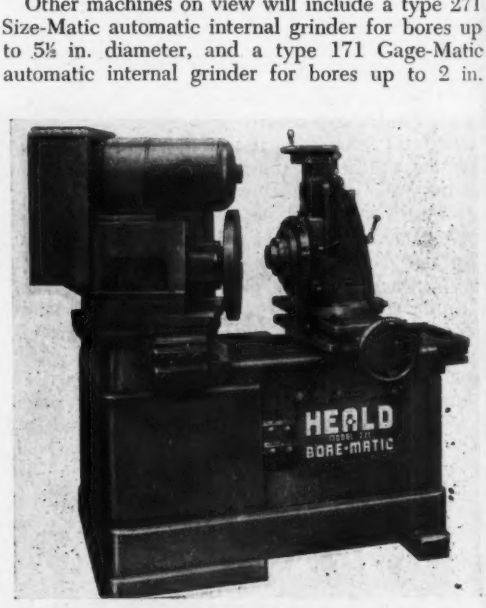


Fig. 24. Heald type 221 universal Bore-Matic with swivel-mounted boring head

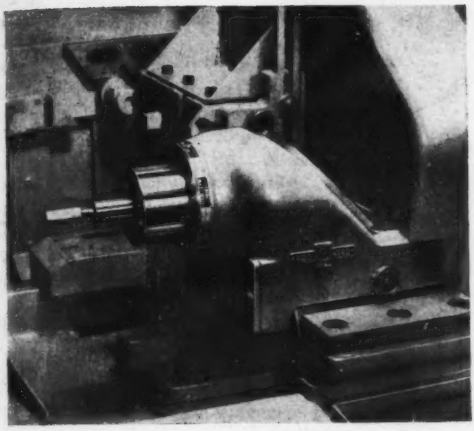


Fig. 25. Heald OB Series, belt-driven, high speed grinding head

diameter by 3 in. long. This latter machine will be equipped with the new OB Series, high-speed, belt-driven wheel-head shown in Fig. 25, which can be arranged to run at 45,000, 52,000, or 60,000 r.p.m. by changing pulleys. With an OOB Series spindle cartridge mounted in the same wheel-head, additional speeds of 70,000, 85,000, and 100,000 r.p.m. are obtainable. The spindle is driven by belt from a countershaft which runs in self-lubricating bearings in the housing, below the cartridge. This countershaft, in turn, is driven by belt from the motor. Constant tension on the spindle driving belt is maintained by a spring-loaded, hydraulically-damped idler pulley. A lubricator, operating at an air-line pressure of 40 lb. per sq. in., is incorporated, whereby oil mist is fed to the bearings at a uniform rate. Should the air pressure fall below a pre-set minimum value, the wheel-head is automatically stopped.

MEYER, ROTH & PASTOR CHAIN LINK BENDING AND WELDING MACHINES

The chain making equipment built by Meyer Roth & Pastor Maschinenfabrik G.m.b.H., Cologne-Raderberg, West Germany [Soag Machine Tools, Ltd., 7 Juxon Street, London, S.E.11], includes the type KB 36 N hydraulically-operated, semi-automatic, link-forming machine shown in Fig. 26, which will produce links from wire of ⅜ in. to 1$\frac{1}{16}$ in. diameter, hot or cold. Normal chain wire with a tensile strength up to 25 tons per sq. in., can be formed cold up to about $\frac{33}{32}$ in. diameter. The maximum outside measurement of the link is 8¾ in., and the output obtainable ranges from three to seven links per min.

This machine is operated electro-hydraulically and is controlled by the operator from a push-button station. A blank is placed in a feed channel and the previously-bent link is held by the operator in position in a recess in a double mandrel. The actual bending process then takes place automatically, and when the tools have returned to their starting positions, the machine stops. For convenience when setting up, the various functions can be controlled individually. All the electrical and hydraulic equipment is housed in the base of the machine, and the main drive is taken from a 10 h.p. motor. As a special feature, a chain conveyor can be fitted on top of the machine to move the finished chain from the working area, which is of particular advantage when the links are being bent hot.

Shown in Fig. 27 is the type KAK automatic chain link welding machine which will handle links made from wire ranging from ¼ to $\frac{33}{32}$ in. diameter and of 2$\frac{13}{32}$ maximum internal length. Chains which have been assembled on an automatic bending machine, and subsequently annealed and cleaned, are fed through the welding machine. After each weld has been upset, the flash at the sides is cut off, and the joint is then smoothed by pressing. Flash still remaining at the top and bottom of the weld is removed at another station. The speed of the machine, which is driven by a 2-h.p. motor, is steplessly variable by handwheel

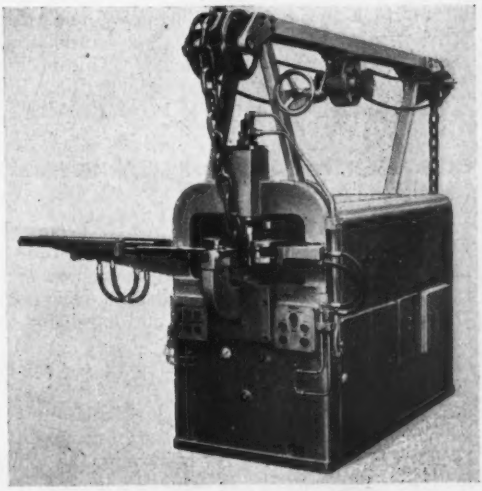


Fig. 26. Meyer, Roth & Pastor type KB 36 N hydraulically-operated, semi-automatic, chain-link forming machine

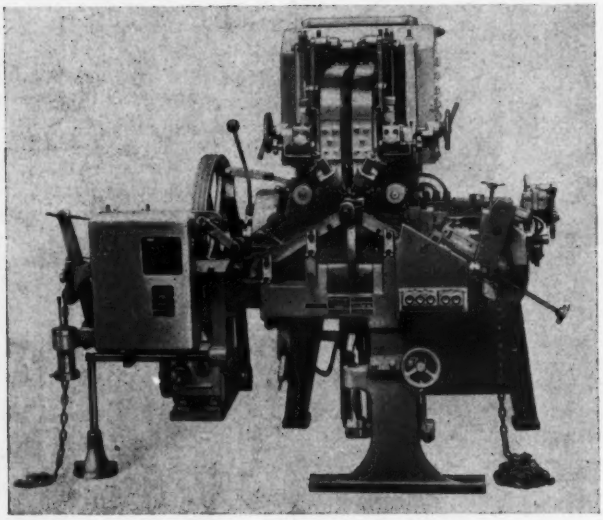


Fig. 27. Meyer, Roth & Pastor type KAK automatic chain-link welding machine

control, and the output ranges from 22 to 35 links per min. If required, ignitron electronic welding current control can be provided to permit steplessly variable regulation. Equipment is also available for the production of chains in short lengths ranging from 2 to 84 links. For welding chain links of high-tensile steel, a time-delay unit can be fitted which ensures that the link is sufficiently cooled before the chain is advanced. This machine is one of a series with capacities for welding links of material ranging from $\frac{3}{4}$ to $1\frac{1}{32}$ in. diameter.

CHURCHILL TYPE S.A.H. 10-IN. GEAR HONING MACHINE

In Fig. 28 is seen the type S.A.H. 10-in. gear honing machine which is being introduced by Churchill Gear Machines, Ltd., Blaydon-on-Tyne, Co. Durham, and is intended for removing nicks and burrs from hardened gears and improving the surface finish.

To facilitate loading and unloading, the honing tool is arranged at the rear of the working area, and is carried on a cylindrical slide, whereby it is advanced towards the work at the beginning of a cycle. During the progress of honing, the tool is held in contact with the work by means of a spring-loaded cylinder, which is mounted on ball ways, and this system serves to ensure that no damage is caused due to eccentricity of the component or by any prominent surface defects. Moreover, the increased pressure which is applied at such points ensures the more rapid removal of the excess metal. For passing wide components across the tool, the work-table can be traversed at steplessly-variable rates.

Drive to the honing head is taken from a 1-h.p. motor through toothed and V-type belts, and the spindle speed can be varied between 200 and 400 r.p.m. In operation, the head is clamped by spring pressure, but it can be released hydraulically for setting the tool at various angles to the axis of the workpiece.

On the company's type S.A.U. 8-in. capacity gear shaving machine, which is also to be shown, the design of the table and knee is such that although the use of an intermediate slide has been avoided, conventional, diagonal or underpass shaving can be carried out. Details of a range of machines of this type were given in MACHINERY, 96/1528—22/6/60 and 97/169—20/7/60. In addition, a No. S.815 Mk. IV Rigid-hobber will be displayed with fully-automatic loading equipment, a conveyor being moved in steps, in synchronism with the operating cycle of the machine. Pairs of workpieces are located on

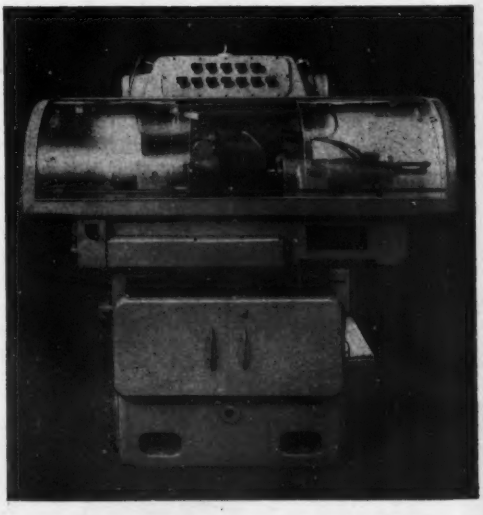


Fig. 28. Churchill type S.A.H. 10-in. capacity gear shaving machine

spigots mounted on this conveyor, and at the beginning of each cycle, two parts are transferred simultaneously to the working area by means of an arm. Finished components are returned to the conveyor, and are subsequently stripped from the spigots and then transferred by a carriage to a discharge tube.

WILHELMSBURGER AP 100/3000, 100-TON PRESS BRAKE

In Fig. 29 is shown an example from the range of mechanical press brakes, with capacities from 50 to 630 metric tons and designed to accommodate sheets of various widths, which are built by Wilhelmsburger Maschinenfabrik (Paul Granby & Co., Ltd., 39 Victoria Street, London, S.W.1). The company's exhibits will include a 100-ton machine which has a 9-ft. 10-in. long bed, will admit 6 ft. 8 in. between the box-section columns of the fabricated steel frame, and can be provided with horn extensions at one or both ends.

Designated AP 100/3000, this machine has a throat depth of 9¾ in., and the stroke length of the bending beam is 3⅛ in. A single operating speed of 80 strokes per min. is normally provided, and drive to the eccentric shafts is taken from an adjustably-mounted 10-h.p. reversing motor through V-belts to a flywheel, and thence by an air-operated clutch to a driving shaft. Alternatively, equipment can be incorporated whereby fast and slow rates, in a given ratio, are obtained automatically, for the approach and return motions and for bending. The eccentric shafts are mounted in high-grade bronze bearings, and the flywheel, the driving shaft, and a second-motion shaft in roller bearings. Provision is made for single-stroke and continuous working, and inching, and there is an indicator on the right-hand eccentric to show its angular position. A brake is incorporated in the transmission, which is applied by means of a spring and released pneumatically. If desired, a unit can be provided which disengages the clutch when a pre-determined load is applied.

The bending beam can be adjusted vertically, to obtain a maximum distance of 16¾ in. between the under-side and the bed, by means of a push-button-controlled 1½-h.p. motor, drive being taken through worm gearing, heavy shafts at both sides, and further sets of worm gears. These shafts can be turned independently, and the setting of the beam is shown on an indicator which can be read to an accuracy of 0·0004 in. If required, the beam can be inclined, and when precision forming is to be carried out, the upper bending tool can be pre-stressed by an adjustable wedge arrangement, to reduce deflection.

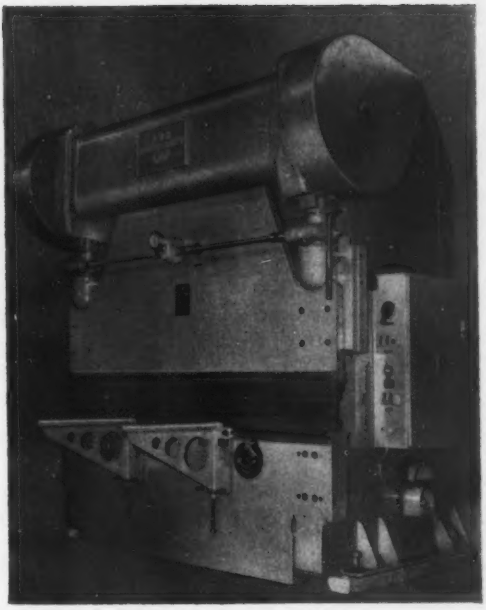


Fig. 29. An example from the Wilhelmsburger range of mechanical press brakes

The back-stop for the work can be adjusted vertically, and is positioned horizontally with the aid of two independent crank handles at the front of the bed, which enable settings to be made parallel with or inclined to the longitudinal axis. A double stop arrangement can be provided, to permit multiple forming operations to be carried out, and the machine can be supplied with fixed or detachable platens for the bed and the bending beam. An attachment is also available which provides for shearing sheets up to ¼ in. thick by 8 ft. 2 in. wide, with a maximum tensile strength of 32 tons per sq. in.

SPECIAL MACHINES BY ARTILLERIE-INRICHTINGEN

In Fig. 30 is shown a specially-adapted lathe which will be exhibited by Artillerie-Inrichtingen, Hembrug-Zaandam, Holland [Kearney & Trecker-C.V.A., Ltd., Portland Rd., Hove]. Intended for operations on 40-mm. cartridge cases for anti-aircraft ammunition, it has been developed from the company's standard type DR 200 lathe. The centre height is 200 mm. (7⅞ in.) and 1,000 mm. (39⅜ in.) is admitted between centres. Operations performed include: machining the outside face at the

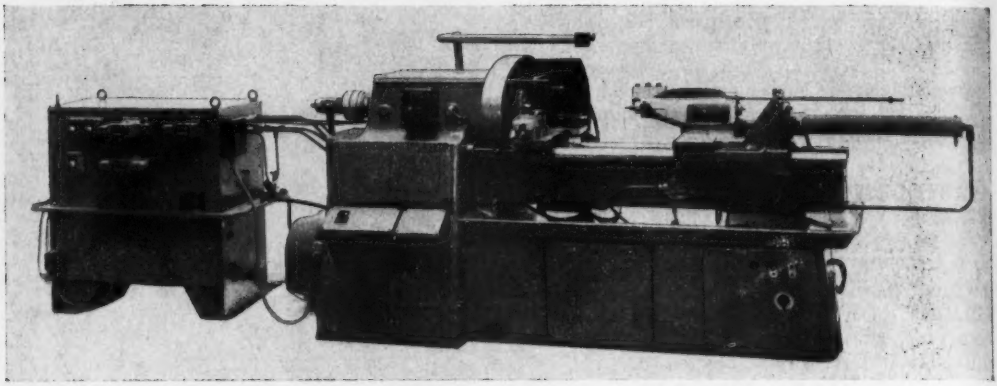


Fig. 30. Artillerie-Inrichtingen lathe arranged for operations on 40-mm. anti-aircraft shell cases

closed end; taking a sizing cut on the rim; and machining a trapezoidal-section groove adjacent to the rim. For these operations, multiple tools are carried on the cross-slide, which is actuated hydraulically.

Next, a drilling operation is carried out with a form tool mounted in the special hydraulically-operated tailstock, and another tool also carried by the tailstock, machines a groove in the end face of the workpiece. The cartridge cases are loaded by hand, and are gripped in the spindle by means of a special air-operated collet. A length stop is provided in the spindle, to locate the workpiece axially, and also serves to support it at the inner end. After loading the workpiece, a button is pressed and the machining cycle is performed automatically. It is stated that a production rate of 100 cases per hour can be maintained.

Another interesting machine which will be exhibited is illustrated in model form in Fig. 31. It has been designed for operations on lathe bed and headstock castings, and has a cabinet base which is T-shaped in plan. The lathe bed and headstock is loaded in the inverted position on a slide which has hydraulic traverse in the longitudinal direction. Location is taken from a ground prismatic guideway on the bed.

Three unit heads are mounted side by side on the cross-slide at the left and can thus be brought successively into position, the work being fed to the tools by traversing the longitudinal slide. Each of these heads has four spindles, and they provide for drilling, and rough- and finish-boring, holes in the end wall of the headstock and feed box, also for roughing the main spindle bores. At the right-hand end of the work-slide, there is a fixed head

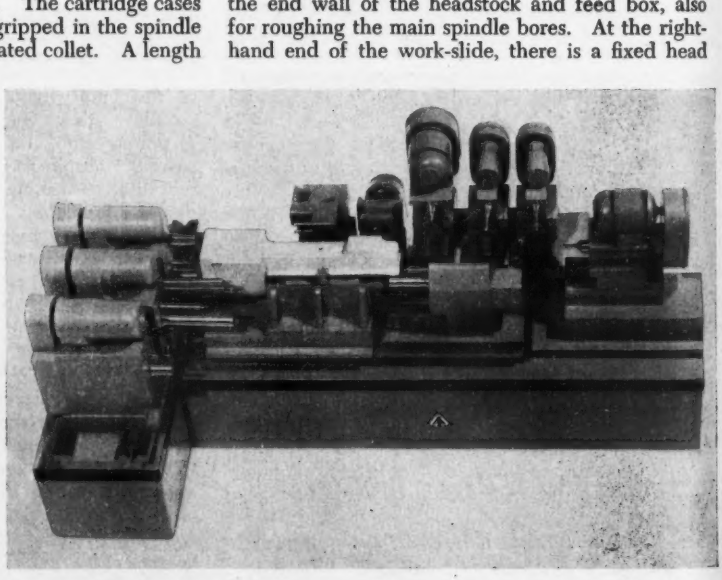


Fig. 31. Model of a special machine developed by Artillerie-Inrichtingen for drilling, boring and milling operations on lathe bed and headstock castings

which carries the bar for finishing the main spindle bores, also the bores for the back-gear shaft.

A series of heads on hydraulically-traversed slides at the rear of the machine provides for operations on the front of the lathe bed and headstock. These operations include milling faces and drilling holes for mounting the leadscrew bearings, and drilling holes for the operating levers in the headstock. On the left of this group there is a head for boring holes for the leadscrew and the secondary shaft of the quick-change gearbox. The head on the right bores the bearing for the leadscrew at the right-hand end of the bed after it has been fitted.

This series of operations is completed in accordance with a pre-set cycle and all slides and units are controlled by an electro-hydraulic system, the oil reservoir and pump, feed valves, and electrical equipment being housed in a cabinet installed adjacent to the machine. It is stated that the machining time is only about 15 per cent of that previously required for these operations.

KENDALL & GENT TYPE FGG. 30 FACE-MILLING CUTTER GRINDING MACHINE

Kendall & Gent, Ltd., Victoria Works, Gorton, Manchester, 18 (Associated British Machine Tool Makers, Ltd., 17 Grosvenor Gardens, London, S.W.1), have recently introduced the type FGG. 30 machine illustrated in Fig. 32, for grinding face milling cutters of the inserted blade type, with diameters from 3 to 30 in.

Two grinding spindles are provided, one of which is driven at a speed of 2,800 r.p.m. and will take a 6-in. diameter cup wheel. The other spindle runs at 4,400 r.p.m., and is fitted with a 5-in. diameter diamond-impregnated wheel for grinding tungsten-carbide tipped blades. Both spindles are driven by a 1½-h.p. motor, and the entire head can be swivelled through 180 deg. so that either wheel can be brought to the working position as required. Power adjustment is provided for the wheel-head on the column ways.

The machine enables face lands and relief angles to be ground on the cutter, also one or more chamfers or a corner radius up to a maximum of 1 in. When a corner radius is required, the entire surface of the blade is ground at a single operation, and setting is carried out with the aid of two dial indicators and a setting piece. Three different, fully-automatic working cycles can be selected by means of a switch on the push-button control panel, and when all the blades have been ground the machine stops. The cutter is located for angle at each indexing position by a flexible steel finger which engages with one of the blades, and with this arrangement, the need for indexing plates is avoided. The wheel-head slide has a maximum travel of 5 in., and can be reciprocated at steplessly-variable speeds ranging from 4 to 80 strokes per min. Cuts can be applied by hand or automatically in four steps ranging from 0·0002 to 0·0008 in. per stroke. If required, the cutter can be rotated continuously for carrying out a cylindrical grinding operation on new blades, in preparation for grinding the face lands and relief angles. Main drive is taken from a 2-h.p. motor.

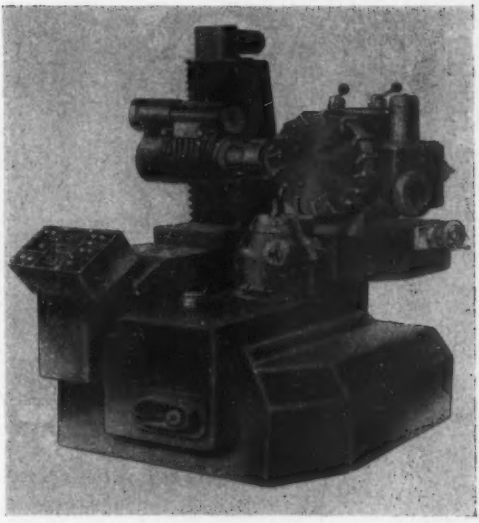


Fig. 32. Kendall & Gent type FGG. 30 machine for grinding face milling cutters

GIUSTINA GRINDING MACHINES

The type R90/C centreless grinder shown in Fig. 33 has been introduced by Giustina S.p.A., Turin, Italy [Elgar Machine Tool Co., Ltd., 172 Victoria Road, London, W.3]. It is suitable for both plunge-feed and through grinding and has a capacity range from $\frac{1}{16}$ to 8 in. diameter. The grinding wheel, of 20 in. diameter by 10 in. face, is driven at a speed of 1,200 r.p.m. by a 16-h.p. motor, and a patented arrangement of three pre-loaded anti-friction bearings is provided for the spindle.

Of 12 in. diameter by 10 in. face width, the control wheel is driven by a d.c. motor with magnetic amplifier which provides steplessly-variable speeds from 12 to 72 r.p.m. There is also a fixed speed of 300 r.p.m. for wheel dressing. If desired, the control-wheel head can be mounted on anti-

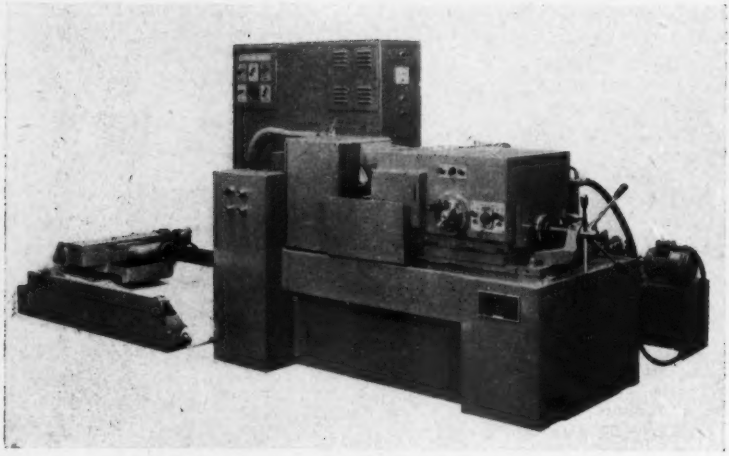


Fig. 33. Giustina type R90/C centreless grinder

friction roller guideways to ensure sensitive movement. Hydraulically-operated diamond dressers, mounted in anti-friction ways, are provided for both wheels. The large-capacity coolant tank is a separate unit, floor-mounted at the side of the machine, as seen at the left in the illustration, and incorporates a filter of the traversing band type.

Automatic loading devices for through- or plunge-feed work can be supplied, and the machine can be set to operate on a fully-automatic or a semi-automatic cycle, wheel dressing being then arranged to take place after a pre-determined number of cycles, or after a preset time. Compensation for the reduction of wheel diameter is made automatically. Other equipment available includes automatic electric gauging devices which apply wheel-head feed, a device for automatically balancing the grinding wheel, and an extractor for removing coolant mist.

The Giustina company also builds, under licence, disc grinders to the designs of the Besly - Welles Corporation, U.S.A., and the type 236 duplex-horizontal spindle machine, seen in Fig. 34, will be exhibited. This machine is equipped with 30-in. diameter abrasive discs and has a maximum feed opening of 7 in. Drive to the spindles is transmitted through timing belts, and the quills incorporate diaphragm seals. Dressing is performed on a push-button controlled automatic cycle, and a compensating increment of feed is applied. Pusher - type through - feed attachments or an oscillating-type indexing feed fixture can be fitted, and automatic gauging equipment is incorporated which controls the wheelhead feed motions. These machines are particularly intended for grinding such parts as bearing races, in the size range from ½ to 7 in. diameter, and it is stated that 3-in. diameter races can be handled at the rate of

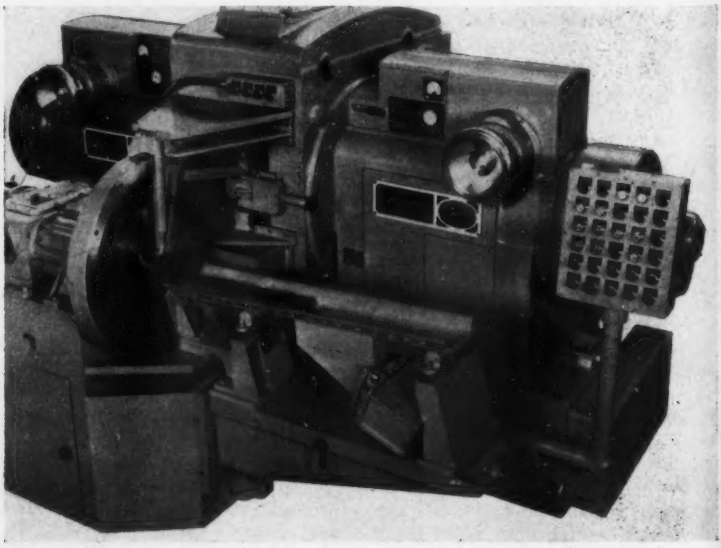


Fig. 34. Besly-Giustina type 236 duplex-horizontal spindle surface grinder

4,500 per hour. The total stock removal is 0·012 in., and a tolerance of 0·0003 in. is maintained on the thickness.

LOEWE TYPE SP OPTICAL PROFILE GRINDER

The latest type SP optical profile grinder made by Ludwig Loewe & Co., Berlin, West Germany (George H. Alexander Machinery, Ltd., 82-84 Coleshill Street, Birmingham, 4), is shown in Fig. 35. It has a 19¾-in. square screen and magnifications of 25 × and 50 × are available, the direct viewing area at 25 × being ¾ in. square, and at 50 ×, ⅜ in. square. The work table measures 11 by 7⅞ in., and it has a longitudinal travel of 9⅞ in., and a cross travel of 2⅝ in. A maximum length of 10 in. can be ground without re-locating the workpiece, and 15¾ in. with re-location. Relief grinding axially can be performed at angles from 0 to 35 deg., and laterally at ±15 deg. The maximum height of the workpiece accommodated is 3⅜ in.

It is stated that the working area is projected with a minimum accuracy of 0·0001 in., and the screen image is upright and non-transposed, and corresponds to the work profile as viewed from the operating position. There are two built-in lighting systems. The lower-illumination, Shadowgraph system is used for grinding flat, unobstructed profiles and radial forms. With this system, the contour of the workpiece appears as a shadow on the bright screen, and continuous observation of the grinding wheel advance is permitted.

The upper-illumination (reflection) system permits, especially for axial form grinding, an accurate positioning of the workpiece as well as observation of the grinding operation. As the image is formed by reflection, it appears bright on the screen. Since the grinding wheel has a reflection factor which is nearly zero, it cannot be projected, but this difficulty is overcome by the use of a "phantom" comprising a highly-polished metal stylus of the same form as the wheel. This phantom, it is stated, is particularly useful when relief grinding, or for operations on workpieces with contoured shapes smaller than the shanks.

Grinding spindle speed is steplessly variable from 1,925 to 3,850 r.p.m., and wheels up to 6 in. diameter can be employed. Drive from the 0·9 h.p. motor is transmitted by an endless woven canvas belt. The stroke length of the grinding head ranges from ⅜ to 3¼ in., and the speed is steplessly variable from 36 to 72 strokes per min. This motion is provided by a crank and link, driven by a variable speed motor of 0·9 h.p.

Manual coarse and fine adjustments are available for the two compound swivelling slides of the grinding head, and the two cradles enable compound axial and lateral relief angles to be ground at the same setting of the workpiece. A dressing attachment is provided directly above the grinding wheel. Equipment available for this machine includes: a motor-driven circular grinding attachment for work up to 6⅞ in. diameter by 7⅞ in. long; a crush roll wheel dressing attachment; a sine-bar dividing fixture for workpieces from 0·118 to 2⅝ in. diameter; and a motorized dust collection unit.

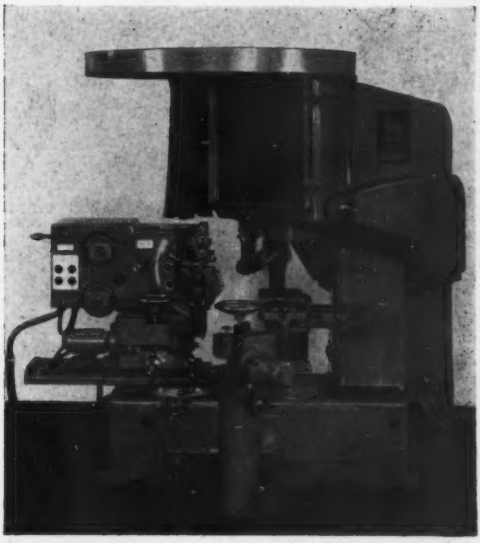


Fig. 35. Loewe type SP optical profile grinding machine

WIEDEMANN TURRET PUNCH PRESS TYPE RA.41P

The British-built Wiedemann type RA.41P turret punch press shown in Fig. 36, which is marketed by Dowding & Doll, Ltd., 346 Kensington High Street, London, W.14, is particularly intended for quantity production work and is capable of punching holes up to 3 in. diameter in 0·074-in. thick mild steel plate of 28 tons per sq. in. tensile strength. A template for the workpiece is clamped to a T-slotted platen immediately in front of the operator, and in this template all apertures in the workpiece, regardless of their size and shape, are represented by ¼-in. diameter holes. Spanning the template there is a pantograph-type slide unit, whereon a vertical plunger can be moved in two directions mutually at right angles.

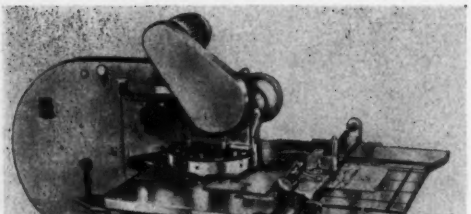


Fig. 36. British-built Wiedemann type RA.41P turret punch press

Movement of this plunger to align it with the various holes in the template serves also to move the work blank beneath the indexing turret. When the plunger is depressed, to engage it with a hole in the template, a switch is tripped to energize the turret, and the required punch is actuated to pierce a hole in the blank. Coloured code lines painted on the template indicate the route to be followed, and by careful planning in this respect the number of movements for a specific workpiece can be kept to a minimum. The machine can also be used for making the master templates.

Twenty turret stations are provided, and the machine is available in two sizes, with worktables measuring 24 by 24 in., or 40 by 28 in. The throat depth is 28 in., and the maximum punch force available is 30,000 lb.

MATHEYS JIG BORING MACHINES

In Fig. 37 is shown the type 35-NC jig boring and milling machine by G. Matheys, Brussels, 3, Belgium (A. A. Jones & Shipman, Ltd., Narborough Road South, Leicester). It has a 33½-by 12-in. table, with a longitudinal travel of 21¾ in., and a cross travel of 11⅞ in. A vertical adjustment of 12⅞ in. is provided for the knee, and the spindle head vertical movement is 5¾ in. The spindle quill, which is superfinished, has a travel in the head of 5½ in.

Drive to the spindle is taken from a motor of 2½ h.p., flange-mounted to a steplessly-variable unit which provides speeds from 80 to 1,680 r.p.m. Three rates of power feed, namely 0·0016, 0·0032, and 0·0064 in. per rev., are available for the quill, also fine feed by handwheel, and sensitive hand feed by levers, which also serve to engage the power feed. The spindle runs in high-precision anti-friction bearings. A locking ring is incorporated which enables the spindle quill to be clamped for milling operations.

All the setting and traverse screws have ground threads, and the nuts are provided with adjustment for taking up wear. If required, the table can be equipped with a gearbox unit and independent motor which provides six power feeds ranging from ⅜ to 5 in. per min.

Handwheels with large graduated dials are provided for positioning the table with medium accuracy, and the optical reading devices and precision scales enable settings to be made to 0·0002 in. This machine can also be supplied with a mechanical measuring system involving the use of length rods, micrometer screws, and precision dial gauges.

A motorized coolant pump and tank, which is readily accessible for cleaning, is housed in the machine base. Equipment available includes an air-driven planetary jig grinding attachment; plain and tilting rotary tables of 12 in. diameter; three sizes of rectangular rotary and tilting tables,

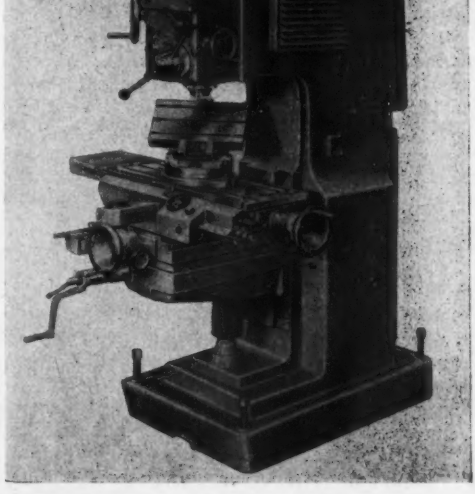


Fig. 37. Matheys type 35-NC jig-boring and precision milling machine

with dimensions of 10⅝ by 6 in., 10 by 8 in., and 14 by 8 in.; single and compound sine tables; and radial-feed and plain micrometer boring bars.

The company will also show the type 3 A/2 bed-type jig boring machine with 29½- by 15¾-in. table (MACHINERY, 97/25—6/7/60) and the type SP-30 knee-type combination jig boring and milling machine with 33½- by 9¾-in. table.

CHIRON DRILLING HEADS AND FEED UNITS

Fig. 38 shows one of a range of three hydro-pneumatically operated unit drilling heads made by Chiron-Werke, G.m.b.H., Tuttlingen/Wurttemberg, West Germany. They are of similar size, and the type 701-1 unit, which has a taper-bored spindle nose to take a chuck, has a maximum drilling capacity in steel of 13 mm. (0·512 in.) diameter. The spindle of the type 762-1 head is arranged to take collets, and the maximum drilling capacity is 10 mm. (0·4 in.) diameter, in steel. Overall spindle stroke is 4 in., and the maximum drilling depth, 3½ in.

Drive to the spindle is taken from a motor of 1 h.p., or, for heavier duty, 1½ h.p., through a Synchroflex toothed belt and change gears, which provide six speeds from 630 to 3,100 r.p.m., or 1,260 to 6,200 r.p.m., according to the motor speed. A 2-speed motor of ⅓/½ h.p. can be fitted, and the speeds obtainable then range from 315 to 3,100 r.p.m. The feed rate is steplessly variable from zero to 12 ft. per min., and rapid traverse is at the rate of 20 ft. per min.

The type 701-6 head is a combined drilling and tapping unit which is driven by a two-speed motor of ⅓/½ h.p., and has 12 spindle speeds from 315 to 3,100 r.p.m. Tapping capacity is from 2 to 12 mm. diameter (0·078 to 0·47 in.). For each head, the automatic cycle is controlled by dogs on a bar attached to the spindle quill, which actuates air valves, and it is stated that the depth of feed can be controlled to an accuracy of 0·002 in. Units can be mounted in any position and may be fitted with electric limit switches for starting and stopping, to enable them to be incorporated in machines operating on automatic cycles. If desired, multiple-spindle heads can be provided, also facilities for step-by-step drilling, and safety features to ensure that a head is switched off if a tool should break.

The Chiron feed units are suitable, for example, for application to milling machine tables, and they are available in three sizes, namely, type 761-1 with a stroke of 4 in., type 762-1 with a stroke of 8⅝ in., and type 763-1 with a stroke of 13⅜ in. Feed rate is steplessly variable from zero to 13 ft. per min., and rapid traverse from zero to 20 ft. per min. Maximum feed force that can be exerted with an air line pressure of 80 lb. per sq. in. is 620 lb.

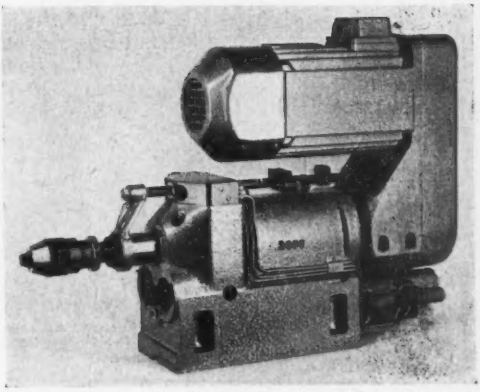


Fig. 38. Chiron automatic-cycle hydro-pneumatic drilling unit

GEWIMAT 8 TAPPING MACHINE

Built by Koenig & Bauer Aktiengesellschaft, Austria (Ringway Machine Tools, 42 Barton Arcade, Manchester, 3), the Gewimat 8 tapping machine has capacity for cutting threads from 0·78 to 0·315 in. diameter in steel and up to 0·59 in. diameter in aluminium, with lengths up to 1·1 in., and can be supplied for bench mounting, with a pedestal stand, or with a column-type stand, as seen in Fig. 39.

Versions are available for semi-automatic and either semi- or fully-automatic working. When tapping is performed semi-automatically, the cycle is started by means of a pedal, and at the end of the working stroke, a clutch is automatically released and another engaged, for reversing drive to the spindle. For fully automatic tapping, operation of the clutches is controlled by means of a disc, and change gears provide for altering the period for which the spindle is allowed to dwell between successive strokes.

During tapping, axial movement is imparted to the spindle under the control of a detachable lead-screw and a pair of half nuts, and each of the latter is formed on a star-shaped member, which can be set for obtaining five different leads. Drive for the tapping head is normally taken from a ½-h.p., single-speed motor, and with this arrangement, spindle speeds of 300, 660 and 1,200 r.p.m. are obtainable. Alternatively, a 2-speed motor can be provided which enables six speeds from

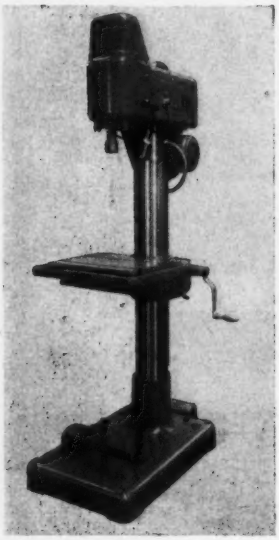


Fig. 39. The Gewimat 8 leadscrew-controlled tapping machine is here shown with a column-type stand

150 to 1,200 r.p.m. to be obtained. The work-table can be adjusted on the column to provide a maximum distance of 26⅜ in. between the 13¾- by 10¼-in. upper surface and the tap holder. Coolant equipment can be supplied at extra cost.

This company will also exhibit the Gewimat 16 column-type semi- and fully-automatic tapping machine, which has capacity for cutting threads from 0·118 to 0·63 in. diameter in steel and up to 0·95 in. diameter in aluminium. Six speeds from 60 to 620 r.p.m. are obtainable for the spindle, to which axial movements are imparted by means of change gearing and a rack and pinion system.

Tibomat 6 and 10 bench-type drilling machines will be displayed, which will drill up to 0·236 and 0·393 in. diameter in steel, respectively, and incorporate a hydraulic system for vertical adjustment of the spindle head. In addition, exhibits will include examples from the Tibomat 13 range of 0·5-in. capacity bench drilling machines, with manual, hydraulic and air-hydraulic feed.

SIGMATROL MEASURING AND GAUGING EQUIPMENT

The Sigma Instrument Co., Ltd., Letchworth, Herts., for whom the sole selling agents in the United Kingdom are Alfred Herbert, Ltd., Coventry, will have a large number of exhibits representative of their wide range of gauging and control equipment. A number of special inspection fixtures will be on view, including some built up from the Sigminor range of standard parts, which enables such equipment to be assembled with a minimum of expenditure. Various types of liquid-column gauging set-ups, also Dialair pneumatic comparators will be included, and in Fig. 40 is shown the Sigma type 10 comparator, which has a scale range of ±0·005 in.

Each division on the scale represents 0·0002 in., and the pointer is moved through a lever and pulley arrangement, which is claimed to provide greater sensitivity than is afforded by a conventional dial indicator movement. The instrument can be used on a 150-mm. (5·9-in.) stand and will serve either as a comparator or a height gauge. Alternatively, a number can be mounted to provide multiple readings, as may be required for production inspection.

There are two manually-adjustable pointers, for setting upper and lower limits, and these pointers may incorporate electrical contacts through which circuits are completed by the movements of the indicating member. Such circuits can be arranged to illuminate pilot lights in a small indicator box, as seen at the right in the figure, or to energize audible alarm signals.

Other items on display will include: high-pressure liquid-column units, operating at a pressure of the order of ten times that of the standard equipment; twin-jet air-gauging head intended for use in general engineering and inspection departments; contact-type air gauging mandrels; a concentricity testing fixture; a fully-automatic Sigmatic inspection machine for quantity-production work; a Sigmatrol unit to control the in-feed motion of the wheel-head on a centreless grinding machine; and a Superset electrical comparator which is capable of indicating to 0·000004 in.

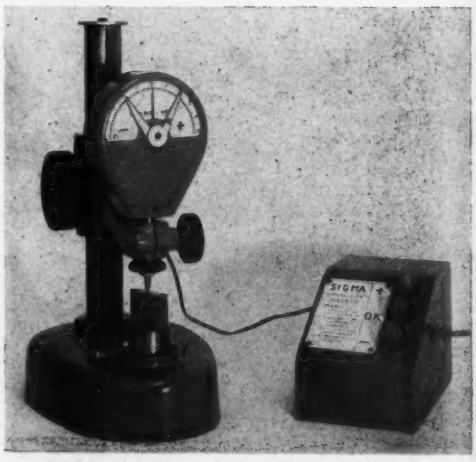


Fig. 40. Sigma type 10 comparator, which has a scale range of ± 0·005 in.

SICMAT TYPE CIP 3 FACING AND CENTRING MACHINE

Operating on an automatic cycle, the type CIP 3 double-ended facing and centring machine, built by S.I.C.M.A.T., Corso Peschiera, 327, Torino, Italy, will handle bar stock from ⅜ to 2¾ in. diameter, and may be fitted with work loading and unloading equipment. Shown in Fig. 41, the machine is available in two sizes which will take bars with maximum lengths of 23½ and 35½ in. Cylindrical bars to be faced and centred are gripped by a pair of hydraulically-operated, self-centring vices, but fixtures can be provided for holding non-circular sections and parts of irregular shapes.

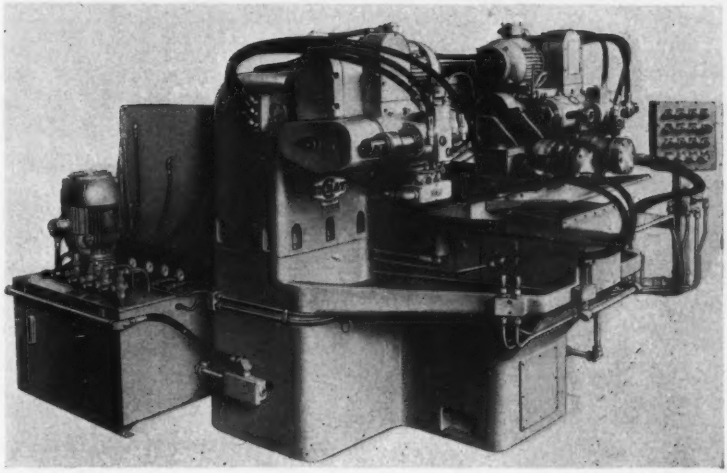


Fig. 41. Sicmat type CIP 3 automatic double-ended facing and centring machine for bar stock from ¾ in.–2¾ in. diameter

After the jaws have been closed to grip the workpiece, the automatic cycle is started by pressing a push-button, whereupon the cross-slide which carries the vices is advanced hydraulically at the rate of 200 in. per min. in a direction towards the milling cutters. At the same time, the coolant supply is turned on. When the work has been brought close to the cutters, rapid power traverse is stopped, and a pre-set feed in the range from ⅜ to 6 in. per min. is applied to the cross-slide, for the face milling operation. At the end of this stage, the cross-slide is rapidly traversed in the opposite direction, to bring the workpiece into line with the centre drilling spindles. Next, the spindles are advanced hydraulically at the rate of 40 in. per min. until the centre drills have been brought close to the ends of the workpiece, and a drilling feed in the range from 0 to 3⅜ in. per min. is then applied. The spindles may be arranged to dwell at the end of the drilling stroke, for a period variable from 0 to 15 sec., to ensure that a good surface finish is obtained on the conical surfaces of the holes. Finally, the spindles are rapidly returned to their original positions, and the coolant supply is turned off, to complete the cycle.

Mounted in large-diameter opposed taper roller bearings, the milling spindles will take cutters up to 4¾ in. diameter. The drilling spindles, which are bored No. 4 Morse taper at the nose ends, run in double-row ball bearings, and have a maximum working stroke of 4 in. In addition to centre drilling operations, these spindles may be employed for machining recesses in the ends of workpieces, and provision is made for setting the cutting depth to an accuracy of 0·0008 in. Both spindles on each head are driven by a 3·15-h.p. motor through pick-off gears, which give a total of 8 speeds from 40 to 225 r.p.m. for milling, and from 460 to 2,350 r.p.m. for centre drilling. For setting up, the various motions of the machine can be engaged independently by push-buttons and switches centrally grouped on a control panel. If required, the machine can be set up for facing or centring only at one or both ends of the work, or the combined operations may be carried out at one end only.

POUILLE TYPE PF 83 HYDRAULIC CIRCULAR SAWING MACHINE

Robert Pouille & Co., 71-73 Rue Jean-Jaures, Armentieres, France [Machine Tool Sales (London), Ltd., 79 Portland Place, London, W.1], will include among their exhibits the type PF 83 automatic hydraulic circular sawing machine shown in Fig. 42. It has a capacity for cutting round bars up to 4½ in. diameter, and other equivalent sections, and the maximum length of automatic feed is 20 in.

The 14 in. diameter by $\frac{3}{16}$-in. thick saw is driven by a motor of 3 h.p., through pump-lubricated spur, worm, and helical gears, and the cutting speed is variable from 23 to 85 ft. per min. Oil

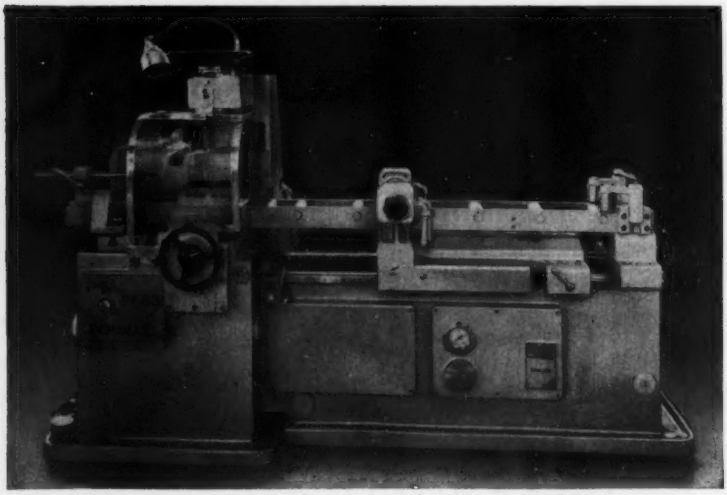


Fig. 42. Pouille type PF 83 hydraulic circular sawing machine

is delivered to the feed cylinder for the saw saddle by a pump unit driven by a 1½-h.p. motor, and a 2-h.p. motor is employed for the stock feed mechanism. Change-over from fully-automatic to semi-automatic operation is made by means of a push-button.

Other machines in the range include the types PF93, PF123, and PF163 with 18-in., 24-in., and 32-in. diameter saws and capacities for bars up to 6 in., 8½ in., and 12 in. diameter. Machines of similar size can also be supplied in a high speed range for cutting light alloys and other non-ferrous materials. The type PF 84 machine, for example, with a 14-in. diameter saw, has cutting speeds ranging from 1,100 to 2,000 ft. per min. and for operations on aluminium and light alloys is fitted with a 15-h.p. spindle motor.

VÄRNAMO MILLING MACHINE

In Fig. 43 is shown the type U2-L universal milling machine built by Varnamo Maskinaktiebolag, Värnamo, Sweden (Mortimer Machine Tool Co., Ltd., 202 Acton Lane, London, N.W.10), which is also available in plain horizontal form (type P2-L). The T-slotted table, with a working surface of 51¾ by 12 in., has a traverse of 33½ in., and on the universal machine it can be swivelled up to 45 deg. in each direction.

Drive to the spindle is taken from a 5-h.p. motor through V-belts and gearing which provides 12 speeds from 36 to 1,600 r.p.m., selected by a single dial and crank handle. The gears are of case-hardened nickel steel and those which run at high speed have profile-ground teeth. Mounted in precision anti-friction bearings, the spindle is of nickel-chromium steel, and has a No. 40 taper nose. A d.c. electric spindle brake is fitted, also an ammeter to indicate the load on the motor.

Power feed and rapid traverse are provided in all directions for the knee, saddle, and table by a 1·2 h.p. motor. The feed gearing is incorporated in the knee, and there is a safety clutch to prevent damage in the event of overloading. There are 12 rates of feed which range from ¾ to 18 in. per min. in the transverse and longitudinal directions, and from ¾

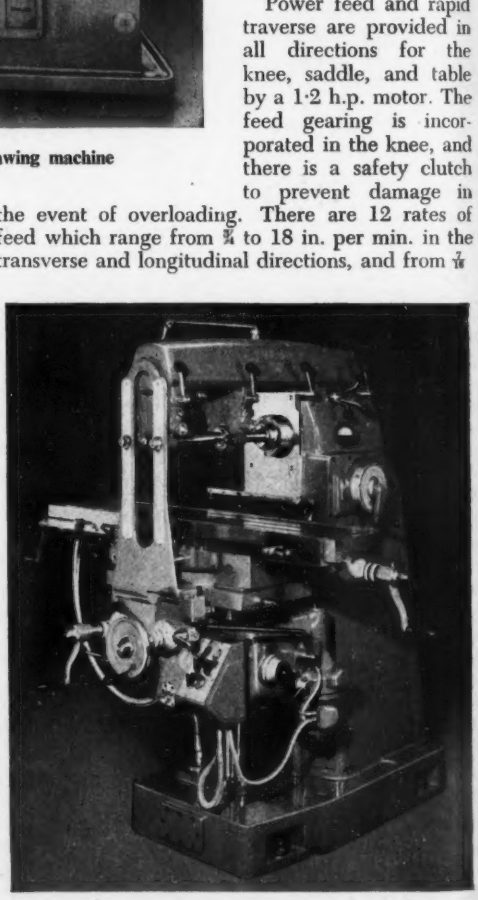


Fig. 43. Värnamo type U2-L universal milling machine which has a 51¾ by 12 in. work-table

to 7¼ in. per min. in the vertical direction. Alternative lower ranges of feed rates can be provided if required. Both the table feed screw and the transverse feed screw have nuts of split construction which are adjustable to take up backlash, to enable climb milling to be performed. Rapid traverse is at the rate of 75 in. per min. longitudinally and transversely, and 30 in. per min. vertically. Apart from the feed gears, which run in oil, moving parts of the knee are lubricated by a conveniently-placed hand-operated pump. The machine weighs approximately 37 cwt., and the castings employed are of Meehanite iron.

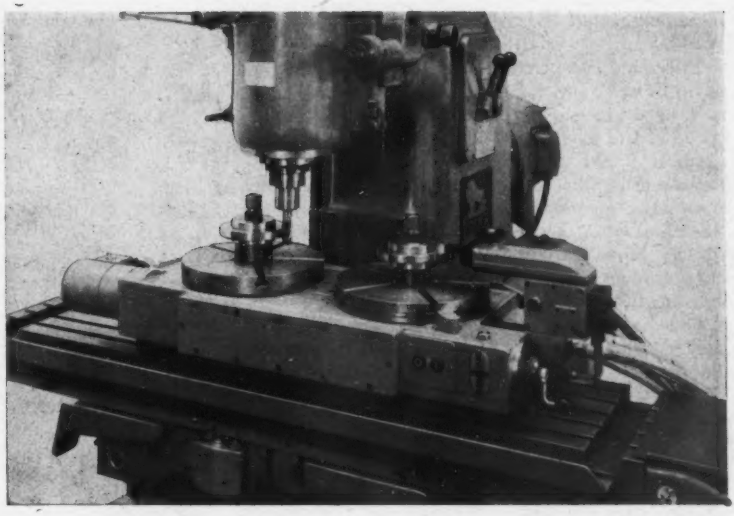


Fig. 44. Stuhlmann Copymat type 70 hydraulic copying table here seen set up for a cam milling operation

Other exhibits will include the company's types EV-3 and EV-5 shaping machines of 18-in. and 24-in. stroke, and the type FU-2 universal milling machine with a 55 by 13 in. table, which was described in MACHINERY, 95/450—9/9/59.

STUHLMANN COPYMAT HYDRAULIC COPYING TABLES

In Fig. 44 is the type 70 Copymat hydraulic copying table made by Richard Stuhlmann & Co., Cologne, West Germany [Stanton Machine Tools, Ltd., Molesey Road, West Molesey, Surrey]. This unit is particularly intended for cam milling. It incorporates a milling table and a master table, each of 12·6 in. diameter, a stylus control, and a hydraulic drive unit, complete with oil reservoir and hoses. The tables are synchronized and driven by a hydraulic motor at steplessly-variable speeds from 0·04 to 0·25 r.p.m. Steplessly-variable rapid traverse, from 0·167 to 1 r.p.m. can also be engaged during the cycle.

A hydraulic copying stroke of 6⅝ in. is obtainable, oil at a pressure of 2,200 lb. per sq. in. being supplied by a pump driven by a 2 h.p. motor. The controls can be set for either clockwise or anti-clockwise table rotation, and when the milling operation has been completed, the tables are stopped automatically. With the aid of a special attachment, cylindrical barrel cams can be milled.

In addition, mention may be made of the Copymat type 60 copying table for milling, shaping, and grinding machines. It has a working surface of 22·8 by 9⅝ in., or 30 by 9⅝ in., when fitted with an extension piece. The maximum vertical copying stroke of the table is 2 in., and a vertical adjustment of 3½ in. is provided for the stylus unit. It may be noted that the copying system employed for these Copymat tables is the subject of patents, and that the stylus pressure is only 3½ oz.

NEW BROWN & SHARPE AUTOMATICS

Brown & Sharpe, Ltd., Plymouth, Devon (Buck & Hickman, Ltd., Otterspool Way, By-Pass, Watford), have recently introduced the type OOB, ½-in. capacity, single-spindle automatic shown in Fig. 45. Of new design, the turret slide of this machine enables turning to be carried out on the work for lengths up to 1¾ in. with a 5-in. diameter cam, and 1½ in. with a 5¼-in. cam. It can be adjusted towards and away from the headstock spindle for a maximum distance of ⅛ in. The spindle, which runs in angular contact ball bearings, is driven by a chain from a 3-h.p. motor. An overall range of spindle speeds from 35 to 7,200 r.p.m. is available, and high and low speeds in a total of 256 different combinations can be brought into use automatically, for example, when threading is to be carried out during the working cycle. There are 18 spindle speeds, from 450 to 7,200 r.p.m. in the

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high range, and the ratio between high and low speeds can be varied in the range 1·6:1 to 15:1.

Fifty-nine cycle times from ¾ to 45¾ sec. or from 1¼ to 91 sec., and a maximum bar feed movement of 1 or 2 in., can be obtained, depending on the speed of the back shaft, which may be 240 or 120 r.p.m. Bored to take ⅝-in. diameter tool shanks, the 6-station turret can be indexed through either one or two positions at any angular position of the lead cam. A new arrangement is incorporated which ensures that the follower roller is maintained in continuous contact with the cam surface during indexing of the turret.

The machine will be shown fitted with a cross drilling attachment on the rear slide, and set up for producing a stepped-diameter bolt, with an overall turned length of 1½ in., from Ledloy hexagonal steel bar (0·324 in. across flats), in a cycle time of 23 sec. An attachment will also be fitted for imparting rapid movement to the turret slide for a distance of ⅜ in., in addition to that provided by the lead cam, for deep hole drilling and for bringing the cutting tools clear of the work before the turret is indexed.

A new No. OOC automatic, which is to be displayed, is of similar design and capacity, but the 18 speeds obtainable for the non-reversing spindle, range from 650 to 10,000 r.p.m. This machine will be shown set up for producing a small brass component, on which thread rolling will be carried out by an attachment on the rear cross-slide.

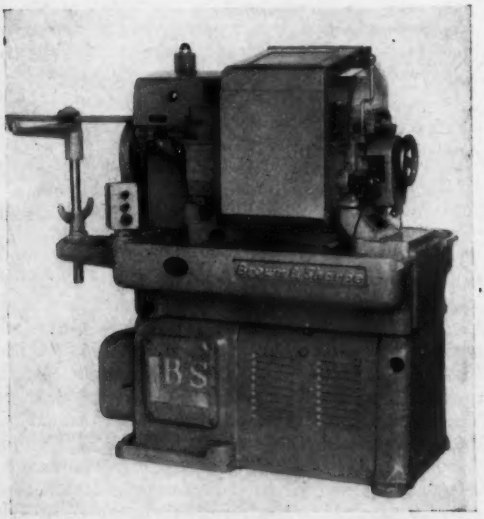


Fig. 45. The new Brown & Sharpe No. OOB, ½-in. capacity, single-spindle automatic

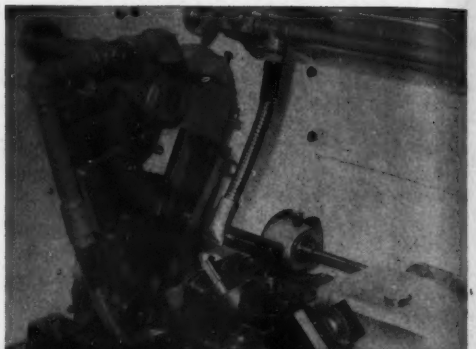


Fig. 46. Close-up view of the new in-feeding twin slide attachment which can be supplied for mounting above the spindle on the Brown & Sharpe No. 2G automatic

A No. 2G automatic will be exhibited fitted with a new attachment incorporating a pair of in-feeding slides mounted above the spindle, as shown in the close-up view in Fig. 46. This machine is available in three sizes which have capacities for bar stock up to ¾, 1¼ and 1½ in. diameter, and normally enable turning to be carried out on the work for a maximum length of 2 in. If required, provision can be made for a maximum turning length of 3 in., when the back shaft is driven at a speed of 120 r.p.m. Spindle speeds from 25 to 5,080, 25 to 3,025, and 25 to 2,180 r.p.m. are obtainable with the smallest, intermediate size, and largest machine, respectively.

There are 18 spindle speeds from 315 to 5,080 in the high range and 15 speeds in the low range on the smallest machine, and the ratio can be varied from 1·6:1 to 15:1. Sixteen spindle speeds from 275 to 3,025 r.p.m. are provided in the high range on the 1¼-in. capacity machine, and 14 speeds from 275 to 2,180 r.p.m. on the largest size, and on each machine there are 12 low speeds and the ratios may range from 1·6:1 to 13:1. A total of 48 cycle times can be obtained, from 3 to 240 or 6 to 480 sec., depending upon the speed at which the back shaft is driven.

UTITA HYDRAULIC COPYING LATHES

Utita Officine e Fonderie di Este., Padova, Italy (Stanley Howard, Ltd., 73 Devon Street, Birmingham 7) will exhibit the type T450/1 hydraulic copying lathe shown in Fig. 47. It will turn a maximum diameter of 17¾ in. and can be supplied with turning lengths of 5 ft. and 9 ft. 6 in. The drive is provided by a 50-h.p. motor and the spindle speeds range from 52 to 520 r.p.m., one speed change being obtained during the automatic cycle. Steplessly-variable feeds are provided, in two ranges, from 0·002 to 0·080 in. per rev. This lathe can also be supplied as the type 450/I/2, with two tool saddles, steplessly-variable spindle speeds from 60 to 285 r.p.m., and a main motor of 80 or 100 h.p.

The type T200 hydraulic copying lathe, also built by the company, can be supplied with entirely manual control or arranged to perform a single-pass or a multi-pass automatic cycle. It will turn work up to 8 in. diameter, and can be supplied in length capacities of 16, 32 and 48 in. The spindle speeds range from 160 to 2,900 r.p.m., and four speeds can be obtained during an automatic cycle. A main motor of 12 h.p. is fitted, and there are two groups of feeds, covering a range from 0·0024 to 0·040 in. per rev.

Another exhibit will be the type T300 AP lathe, with a turning capacity of 11¾ in. diameter, which can also be supplied for manual control or arranged to perform an automatic multi-pass cycle. It is available with length capacities of 30, 40 and 60 in. The main motor is of 25 h.p. and the spindle speeds range from 75 to 1,550 r.p.m., six speeds being obtainable automatically during the cycle. Steplessly-variable feeds from 0·0024 to 0·040 in. are available in two ranges.

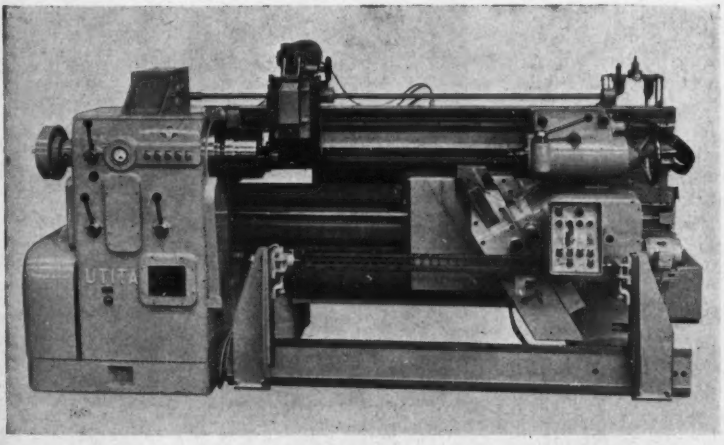


Fig. 47. Utita type T450/I semi-automatic hydraulic copying lathe

FRORIEP TYPE BF160 HORIZONTAL BORING AND MILLING MACHINE

The type BF160 horizontal, travelling-column boring and milling machine from the range made by Maschinenfabrik Froriep G.m.b.H., Rheydt, West Germany (Chas. Churchill & Co., Ltd., Coventry Road, Birmingham) is shown in Fig. 48. It has a 6¼-in. diameter spindle, which gives a boring depth, at one setting, of 52 in., and a 29-in. diameter face plate. The travel normally provided for the spindle saddle on the column is 79 in., and for the column along the bed, 9 ft. 9 in. A maximum diameter of 45 in. can be machined with the boring spindle, and 65 in. diameter with faceplate tools, and milling cutters up to 12 in. diameter may be mounted on the spindle.

A Ward-Leonard converter supplies current for the 30-h.p., d.c., main motor, and steplessly-variable motor speeds from 112 to 1,120 are obtained by armature control, and from 1,120 to 2,100 r.p.m., by field control. A total spindle speed range of 1·3 to 500 r.p.m., is available through reduction gears, the spindle sleeve being driven by a faceplate gear rim, for speeds from 1·3 to 80 r.p.m., and by a spur gear for speeds from 8 to 500 r.p.m. If desired, a 2-in. diameter internal spindle may be incorporated which has a stepless speed range from 16 to 1,000 r.p.m. A faceplate with continuous cross feed for the tool-holder can be fitted in place of a T-slotted faceplate, and when it is in use, the high range of spindle speeds is inoperative.

Two cylindrical roller bearings are employed for the spindle sleeve, and the end thrust is taken by ball bearings. The nitrided steel spindle, which rotates with the sleeve, moves axially in bronze bushes at each end, and is supported at the rear in a circular guide extension of the saddle.

Drive to the feed gearing, which is housed in the column base, is taken from a motor of 10 h.p., with Ward-Leonard control, and

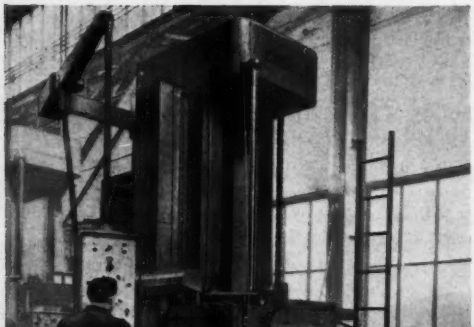


Fig. 48. Froriep type BF160 6¼-in. spindle horizontal boring and milling machine

steplessly variable rates are available vertically and horizontally, from 0·118 to 71 in. per min., for milling, and from 0·008 to 28·4 in. per min. for the boring spindle. Creeping motions at medium and fine rates are also available for the column, spindle saddle and boring spindle. The bed and column guideways are automatically lubricated, and the guiding surfaces of the column are lined with Dytron plastics strips.

The machine exhibited will be equipped with a photo-electric co-ordinate setting system which is stated to give a positioning accuracy of 0·0008 in. The next co-ordinate position can be selected while boring or milling is being performed at the previous position, and the traverse motions can be engaged in both directions simultaneously when making the setting. Other equipment available includes angular milling heads, a copy milling attachment, taper turning and thread cutting attachments, and a grinding attachment.

BRUMECA UNIVERSAL GRINDERS

Diameters up to 10¾ in. can be swung on the Belgian-built Brumeca type R.U. Hyd. 5010-B universal grinder (Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11), and distances up to 20, 29¾ or 39¾ in. are obtainable between the work-head and tailstock centres, depending upon the length of the bed. Shown in Fig. 49, the machine will take grinding wheels up to 12 in. diameter by 1 in. wide, and drive to the spindle, which runs in Hydrofilm, pressure-lubricated plain bearings, is provided by a 4-h.p. motor.

The wheel-head can be swivelled through a maximum angle of 45 deg. to the left, and 60 deg. to the right, and in-feed, which can be varied from 0·0001 to 0·0005 in. per table stroke, and rapid power traverse motions, are imparted hydraulically. In-feed can be applied in increments of 0·0001 in. by depression of a plunger at the front of the bed, also continuously, as required for plunge grinding. The in-feed movement is automatically disengaged when the work has been brought to the required diameter, and the wheel-head can be caused to dwell for a variable period for sparking out at the end of a plunge grinding operation. Separate micrometer drums are provided for accurately setting the wheel-head movements for traverse and plunge grinding work. Automatic work-sizing equipment can be provided if required.

The table which carries the work-head and tailstock can be swivelled in either direction for taper grinding, and steplessly-variable traversing speeds ranging from 4 to 240 in. per min. are obtainable for the table slide on the bed-ways, by a separate hydraulic system. The slide can be caused to dwell at either or both ends of its travel for variable periods, which can be pre-set by means of separate

Fig. 49. Brumeca type R.U. Hyd. 5010-B universal grinder, which will swing 10¼ in. diameter

knobs on the front of the bed. Automatic lubrication is provided for the bed-ways and the guide-ways for the wheel-head slide. The work-head can be swivelled through 90 deg. in either direction, and, if required, may be fitted with a magnetic chuck to permit end faces of work-pieces to be ground with the periphery of the wheel. Drive is taken from a ½-h.p. motor, and steplessly-variable work speeds ranging from 60 to 360 r.p.m. are available, selection being made by means of a handwheel on the front of the head. Mounted in precision ball bearings, the hollow work-head spindle will take a No. 3 Morse taper shank, and a pipe for coolant may be passed through the bore when internal grinding is to be carried out.

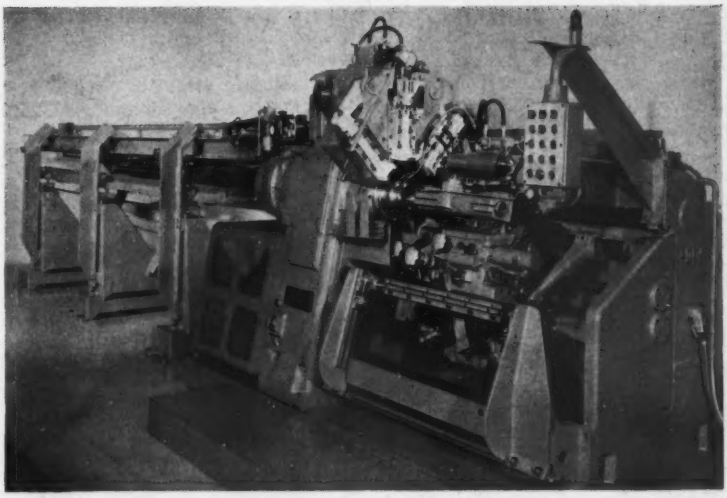


Fig. 50. +GF+ New Britain type KDM-18R copying lathe

Of the swing-down type, the internal grinding attachment is driven by a separate ½-h.p. motor, and can be fitted with interchangeable wheel spindles which are designed for operation at different speeds ranging from 18,000 to 35,000 r.p.m.

A type 5023 universal grinder, which will also be shown, will swing a maximum diameter of 15 in., and is available in different bed lengths to enable a maximum of 39% and 60 in. to be held between the centres. It will take an 18-in. diameter by 3-in. wide grinding wheel.

+GF+ NEW BRITAIN TYPE KMD-18R COPYING LATHE

The +GF+ New Britain type KDM-18R copying lathe shown in Fig. 50, which is built by Georg Fischer A.G., Schaffhausen, Switzerland (Vaughan Associates, Ltd., 4 Queen Street, Curzon Street, London, W.1), is intended for producing ring shaped components from tube stock in diameters from 4 to 8 in., and lengths up to 160 in. The copying slide, which has a working stroke of 6·3 in., also the saddle and template holder, are similar to those employed on the +GF+ type KDM-18-25/70 copying lathe, but the headstock and spindle assembly, tool-holder for turning and boring, workpiece stop, overhead slide attachment, and tube feed unit, are of new design. A programme control system is incorporated which provides for fully automatic continuous operation, and when the length of the tube stock has been reduced to about 4 in., the machine stops and a signal lamp is lit. The lathe will be shown set up for producing inner races for taper roller bearings, which have an external diameter of 7·85 in., a bore of 5·97 in., and an overall length of 2·67 in., at the rate of 44 per hour.

The headstock is cast integral with the left-hand column, and drive is taken by a timing belt from a 45-h.p. motor. Ten spindle speeds are available, which may range from 139 to 595 or from 201 to 840 r.p.m. Bored 9 in. diameter, the headstock spindle will take interchangeable collets for gripping tubes of different diameters within the capacity of the machine. The collet is moved to the left by a stack of spring washers to apply gripping force to the tube, and is opened by an air cylinder. There are 8 sliding feeds ranging from 0·003 to 0·028 in. per rev., and the saddle may be rapidly traversed on the bed-ways at the rate of 98·4 in. per min., when the headstock spindle is stationary, if required, by a separate 3-h.p. motor.

A maximum of three overhead slides can be provided, and they are operated by cams which are driven from the headstock spindle through gearing. These slides have a working stroke of 2 in., and 6 different in-feeds ranging from 0·002 to 0·006 in. per rev. can be obtained by means of

pick-off gears. The central slide provides for taking rough plunge cuts on the work, and that on the right-hand side, as viewed, is intended for parting off. A third in-feed slide is supplied as extra equipment. The cams are driven at an increased speed for imparting rapid traverse to the slides, to bring the cutting tools close to the work, and at the end of this movement, in-feed is engaged by an electro-magnetic clutch in the gearbox. The shape of the cam tracks is such that the slides are rapidly returned to their outer positions as the cams continue to rotate at the lower speed at the end of the cutting operation. An air-operated unloading arm, mounted on the overhead slide attachment, is pivoted at its upper end, and has a hook-shaped lower end to receive the work when parting off has been completed. The arm is then swung in a direction towards the front of the machine for discharging the completed workpiece into a container attached to the headstock.

Mounted on the saddle, the tool-holder for turning and boring may be brought into use simultaneously with the copying slide, so that internal and external surfaces on the work may be completed at a single operation. At the end of the machining stroke of the saddle, the turning or boring tool is brought clear by an air cylinder, to avoid marking of the work surface during the return travel. Carried on separate bed-ways, the work stop has fine adjustment towards and away from the spindle nose, and incorporates a swivel arm which is swung inwards to the working position after a completed workpiece has been parted off from the tube. The collet is then opened, the bar advanced into contact with the arm, and the collet closed, after which the arm is returned to its original position.

The tube feed unit incorporates a pusher bar attached to a pair of roller-mounted carriages, which are suspended from the lower flange of an I-section guide rail. A mandrel attached to the pusher bar serves to support the left-hand end of the tube when the lathe is in operation. When the collet has been opened at the end of a machining cycle, the carriages are moved on the rail by an air motor, through a roller chain, and the tube is thus moved into contact with the work stop by the pusher bar.

R-G HIGH-SPEED HYDRAULIC PRESS

Marketed by Dowding & Doll, Ltd., 346 Kensington High Street, London, W.14, the British-built R-G 5-ton hydraulic press shown in Fig. 51 is representative of a range intended for high-speed blanking and piercing operations, also for forming and bending, clipping, marking, and assembly work. Ram movement is derived from a double-acting cylinder, and the hydraulic circuit incorporates an accumulator which provides for a rapid advance to the working position. A slow approach movement is automatically engaged, and full working pressure is exerted immediately the load is applied, and at the end of the stroke the pressure can be maintained for a predetermined period. The approach speed of the ram is 1,000 in. per min., the working speed 35 in. per min., and the return speed 650 in. per min. On the return stroke, the force exerted on the ram is 2 tons.

Fig. 51. British-built R-G 5-ton high-speed hydraulic press

Speed of the ram during the working part of the stroke, also the pressure applied, are controlled by a conveniently-placed regulator, and the ram is prevented from turning by a spring-loaded plunger. The stroke is adjustable up to a maximum of 4 in., and the maximum distance from the table to the nose of the ram is 12 in., and the throat depth, 7 in.

At the Exhibition, a 10-ton version of this machine will be shown in conjunction with a 4- or 8-station rotary indexing table. The 5-ton machine illustrated can be supplied for bench-mounting, and for pedal or push-button control.

BOLEY MULTI-SPINDLE DRILLING AND TAPPING MACHINE

G. Boley, Esslingen/Neckar, Germany (Burton, Griffiths & Co., Ltd., Mackadown Lane, Kitts Green, Birmingham, 33), have introduced the type VB/VG multi-spindle drilling and tapping machine shown in Fig. 52. This machine can be supplied to take a maximum of 10 or 13 individual spindle units, which can be adjusted for centre distance, and enable holes up to $\frac{7}{8}$ in. diameter to be drilled in steel on circles up to $6\frac{1}{2}$ in. diameter, and within rectangles up to $11\frac{13}{16}$ by $7\frac{7}{8}$ in. The individual

spindle assemblies are available in different diameters, and various types of spindle carriers can be supplied. Alternatively, fixed-centre, multiple-spindle drilling heads can be provided.

For drilling, drive is normally taken from a 3-h.p. motor, and 4 spindle speeds, which may range from 750 to 3,000, or from 530 to 2,200 r.p.m., are available. A 2-speed reversing motor can be fitted when drilling and tapping is to be carried out, and the 8 spindle speeds then obtainable may range from 375 to 3,000 or from 265 to 2,200 r.p.m. From the motor, drive is transmitted to the drilling spindles by a belt and stepped pulleys, and finally by universally-jointed shafts.

Rapid power traverse upwards, steplessly-variable drilling feeds, and quick return movements are imparted to the work-table on an automatic push-button controlled cycle by a built-in air-hydraulic system. The table has a working stroke of 5¼ in., and a maximum distance of 13$\frac{3}{16}$ in. is obtainable between the 17⅜- by 9½-in. top surface and the ends of the drilling spindles. Provision is made for stopping the table, and returning it to the starting position, at any point in the operating cycle, if required. An adjustable relay can be incorporated in the control system, which can be set so that drilling is carried out for a period of 1 to 10 sec., whereupon the table is rapidly moved downwards for 0·1 to 1 sec., for the purpose of clearing swarf, when holes are being drilled for a considerable depth. At the end of the downward travel, the table is rapidly returned upwards, and feed is then resumed. At the same time, the relay is re-set. When particularly sensitive feed is required for certain drilling and tapping operations, the table can be disconnected from the piston rod of the air-hydraulic cylinder, and traversed manually by a lever. For such work, the table can be counter-balanced by springs. If required, a table with a working surface of 6½ by 11$\frac{7}{16}$ in. can be provided, which is intended for operation by a lever or a pedal. A working stroke of 2 in. is obtained with the lever, and of 1⅝ or 2⅝ in. with the pedal.

Coolant equipment is provided. The machine weighs approximately 10 cwt., and occupies a floor space of 32 by 22 in. A swivel-mounted seat for an operator can be supplied, as shown.

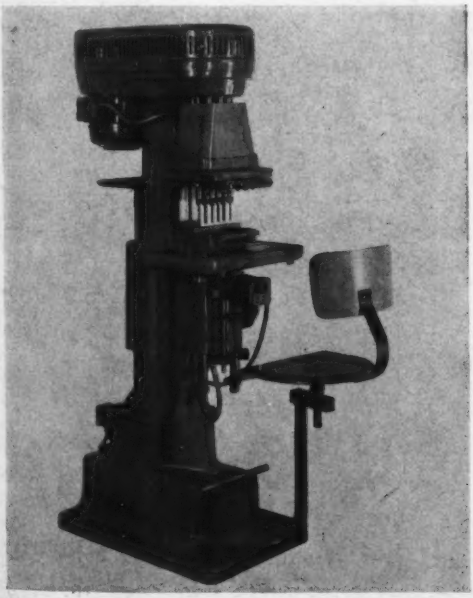


Fig. 52. Boley multi-spindle drilling and tapping machine to take up to 10 or 13 spindle units

FOREST TYPE H. 800 A-O HORIZONTAL MILLING AND BORING MACHINE

Forest & Co., 16 Rue de la Paix, Paris 2e, France (Stanhope Machine Tools, Ltd., 202 Acton Lane, London, N.W.10), will show the type H. 800 A-O horizontal milling and boring machine illustrated in Fig. 53. The working surface of the T-slotted table measures 9 ft. 3 in., by 2 ft. 8 in., and the longitudinal traverse is 8 ft. 2 in. A vertical traverse of 40 in. is provided for the spindle saddle on the column, and the spindle head has a transverse travel of 20 in.

The spindle is mounted in high-precision taper roller bearings and there are 16 speeds ranging from 20 to 1,500 r.p.m., which are selected hydraulically. For the eight high speeds, only two gears are in mesh between the spindle and the motor. The latter may be of 10 or 20 h.p., depending upon the duty for which the machine is required. Steplessly-variable feeds, controlled by electro-magnetically operated disc clutches, range from 0·59 to 59 in. per min. longitudinally and vertically and from 0·28 to 30 in. per min. transversely. Rapid traverse at the rate of 10 ft. per min. is available for all three motions. Lubrication of the machine is by a one-shot system.

If required, the machine can be arranged to operate on an automatic cycle which includes positioning of the spindle head transversely, and provision can be made for climb milling, also for automatic tool changing.

Reference may also be made to the recently-developed type V.500 C-1 vertical, hydraulic, copy milling machine of the fixed bed type, which has a table travel of 31½ in. Spindle speeds from 45 to

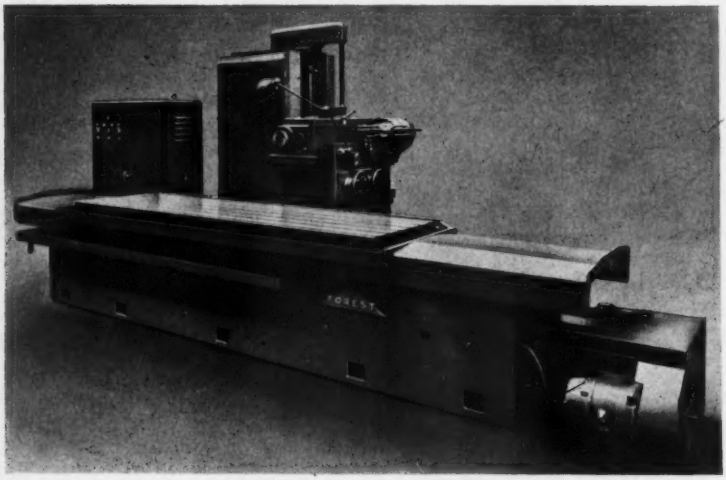


Fig. 53. Forest type H. 800 A-O horizontal milling and boring machine

2,000 r.p.m., or 70 to 3,200 r.p.m., can be provided, and the steplessly-variable feed rates range from 0·59 to 15½ in. per min., with rapid traverse at 10 ft. per min. Machines with longer table traverse can be supplied if required.

LANDIS-MAIDEN TWIN-SPINDLE THREADING MACHINE

The twin-spindle threading machine shown in Fig. 54 has recently been added to the MB range built by Landis Machine-Maiden, Ltd., Hyde, Cheshire, and can be equipped with Lanco type R tangential die-heads, to provide a maximum capacity for bolts and tubes up to 1½ in. diameter.

Each head is arranged for automatic release, by means of a system which is operated by the associated saddle, and can be closed either by moving the latter away from the headstock or with the aid of a lever. Alternative heads of various sizes which can be fitted include the 1½-in. type S, which enables taper threads to be cut on tubes up to 2 in. (nominal) bore diameter, and the example to be exhibited will be equipped with 1¼-in. type T units, each of which incorporates an internal automatic release mechanism.

Drive to the totally-enclosed headstock is taken from a 5-h.p. motor through V-belts, and eight speeds are obtainable individually for the spindles by means of pick-off gears. Both the spindles are driven in the same direction, and they run in bronze bearings. Each saddle is provided with long sliding surfaces, and is guided on replaceable hardened and ground strips, which are attached to the ways on the bed. Traverse movements are normally applied by means of a lever, which provides a travel of 6 in. for a single stroke. If required, however, a handwheel-operated pinion and rack system can be incorporated. A manually-operated hammer-action vice is usually provided, which enables a high gripping force to be exerted to the work with comparatively little effort, and it can be adjusted vertically and horizontally on the saddle, for aligning the work with the die-head. Coolant equipment is supplied, and the base of the machine includes space for a substantial quantity of cuttings.

Design improvements have been made to the 1½

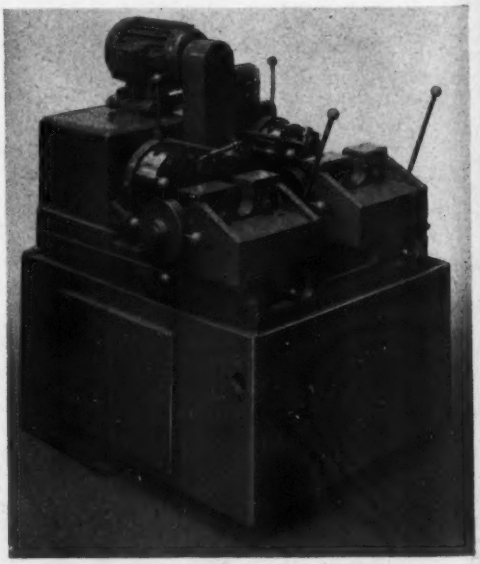


Fig. 54. Landis-Maiden twin-spindle threading machine which can be equipped with 1½-in. capacity Lanco type R tangential die-heads

MB production threading machine, which has a capacity for bolts from ⅜ to 1½ in. diameter and tubes from ¼ to 1½ in. diameter, and the bedways are now provided with replaceable hardened and ground strips. Automatically-operated, pneumatic work-holding equipment is mounted on the saddle, and on the machine to be displayed, movements are applied to the latter member under leadscrew control.

Bolts from ½ to 2½ in. diameter and tubes from ¼ to 2½ in. diameter can be handled on the 2½ MB machine, which is equipped with a Lanco type R tangential die-head. The headstock normally provided gives a total of 9 spindle speeds from 18 to 150 r.p.m., but alternative headstocks are available, and there is also a choice of spindle bearing arrangements. This machine can be supplied with three bed lengths and with leadscrew control for the saddle. A lever or a handwheel system can be incorporated for traversing the latter, and the work-holding equipment may be either hand- or air-operated.

Primarily intended for maintenance work, the 4C/ST machine has a capacity for bolts from ¼ to 2 in. diameter and tubes from ¼ to 4 in. diameter, and provides for cutting both parallel and taper threads. The forged steel, radial-type die-head is opened and closed by means of a lever without the need for stopping the spindle.

SCHOU NO. 330 HEAVY-DUTY TRAVELLING-HEAD SURFACE GRINDING MACHINE

Workpieces with heights up to 30 in. can be accommodated on the 47- by 30-in. work-table of the Danish-built Schou No. 330 heavy-duty travelling-head surface grinding machine shown in Fig. 55 (Stedall Machine Tool Company, 192 Pentonville Road, London, N.1), and faces measuring 51 by 13⅜ in. can be ground at one setting.

Drive to the grinding head is taken from a 4-h.p. totally-enclosed motor, and an 8-piece segmental-type wheel is mounted on the vertical spindle. A lever-operated, swivelling, dressing unit is provided at the left-hand side of the head. The latter can be adjusted vertically through a distance of 10 in., and to enable feed increments to be applied accurately, the plunger of a dial gauge can be brought into contact with the upper surface of the work.

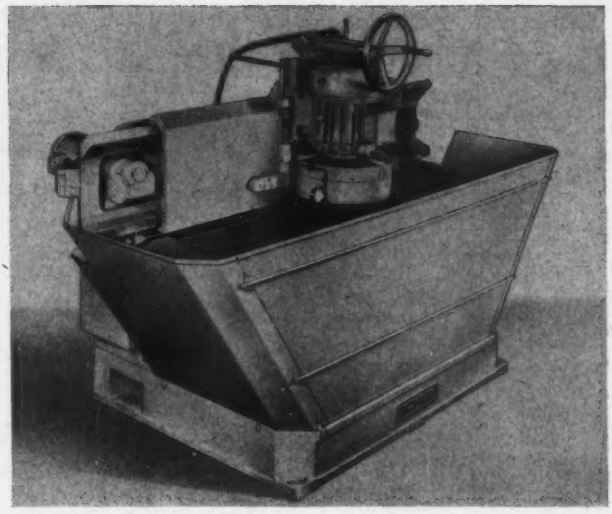


Fig. 55. Schou No. 330 travelling-head surface grinding machine

The long saddle member which carries the head is mounted on horizontal ways on a cross-rail, which is bolted to the upper ends of two columns at the rear, and is reciprocated by means of a separate motor and gearbox. Traverse rates of 23 and 46 in. per min. can be obtained, and adjustable stops on a long cylindrical bar below the rail provide for reversing the motion at each end of the stroke.

Coolant equipment is incorporated, and there are large, removable, splash guards for the front and the sides of the working area. The overall dimensions of the machine, which weighs 1¾ tons, are approx. 7 ft. 6 in. long by 3 ft. 6 in. wide.

STRIPPABLE BARRIER FILM FOR PAINT SPRAY BOOTHS. A new material which can be applied to paint spray booths to provide a barrier between the walls and overspray paint has recently been introduced by the Metal Finishing Division of The Pyrene Co., Ltd., Great West Road, Brentford, Middlesex. Known as Pultac No. 2, the material can be applied to the walls by spray gun and forms a tough but easily-removable film. It can be employed for coating steel, aluminium, galvanized iron, vitreous enamel, glass and tiles, dries quickly, and is stated to be resistant to overspray almost immediately.

The new material is available in cans of 1 gal. and 5 gal. capacity.

Making Petrol Dispensing Pumps

Methods and Equipment Employed for the Production of Components and Assembly by Vickers-Armstrongs (Engineers), Ltd., Crayford, Kent

By P. A. SIDDERS, Chief Associate Editor

PREVIOUS ARTICLES IN THIS SERIES* devoted to the production of petrol dispensing pumps at the works of Vickers-Armstrongs (Engineers), Ltd., Crayford, Kent, under an arrangement with the Gilbert & Barker Mfg. Co., Springfield, U.S.A., have been concerned with operations on the metering pump body and associated cylinder liners, the air separator housing, the main pump body, the main pump rotor, and the clock case. Some further machining operations on petrol pump components are here considered, and reference is also made to the assembly of pumps.

In the metering pump assembly there are cams whereby the reciprocating motion of the four pistons of the pump is translated into rotary motion which is applied to the volume indicating mechanism. These cams are machined from castings of nickel-chromium iron, one of which is seen at the right in Fig. 1. Castings are first machined on capstan lathes, and the operations include facing both sides of the flange, and facing, turning, drilling, reaming, and countersinking the boss. An offset hole is then drilled, reamed, and countersunk in the flange of each workpiece, and the cam blanks are next passed to the first of two Pratt & Whitney automatic machines on which the profiles are milled. At the left in Fig. 1 is seen a cam blank ready for profile milling, and in the centre, a completed cam after the periphery has been burnished, as will later be described.

Fig. 2 is a close-up view of the set-up on the second Pratt & Whitney machine, which provides for semi-finishing the profile. The arrangements on the first machine, for rough milling, are similar, and 0·006 to 0·005 in. of metal, a side, is left on the workpiece after the roughing stage. On the work-spindle of the machine is mounted a fixture *A*, with a raised central portion, which has a recess near one edge to accommodate the boss on one side of the cam blank. The blank is located on the fixture by a spigot, with an integral stud, with which the main bore is engaged, also by a peg that enters the hole in the flange to provide for angular positioning. When the blank has been loaded, it is secured by a nut on the stud of the spigot.

The complete work-head is arranged to rock, and is mounted on a shaft which is carried in bearings at the front of the machine, as indicated at *B*. A heavy weight is coupled to the head by a chain *C*, and urges it to the rear. On the end of the work-spindle is mounted a master cam *D*, the profile of which corresponds to that required on the workpiece. The radii of the master-cam form, however, are three times those of the work profile, so that the rises and drops are "smoothed out", and the milling operation is thus facilitated. Under the action of the weight, the periphery of the master cam bears against a roller on a slide (just visible at *E*), which can be adjusted on transverse guideways on a bracket secured to the machine bed to the left of the workhead. Adjustment is carried out by means of a screw keyed to the hand-wheel *F*, and serves for increasing or decreasing the depth of cut. Drive to the work-spindle is engaged by means of

* MACHINERY, 98/1332—14/6/61 and 99/292—9/8/61.

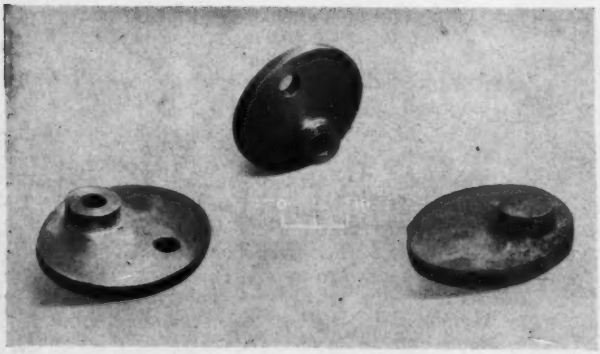


Fig. 1. A finished cam for a metering pump is seen in the centre, with a cast blank at the right and a blank after the first machining stage on a capstan lathe

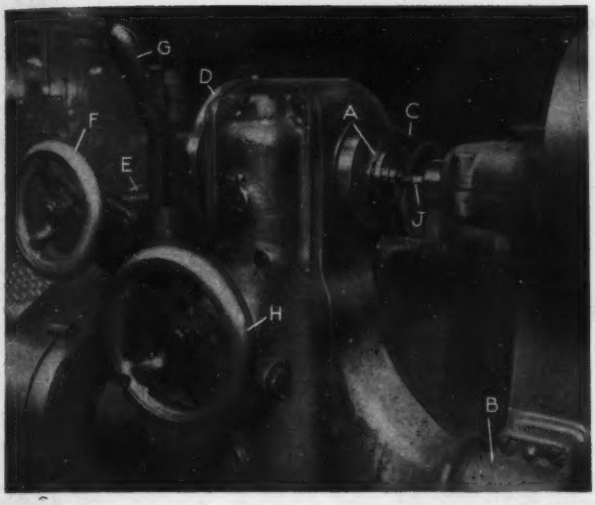


Fig. 2. Close-up view of the set-up for semi-finish milling the cam profile on a Pratt & Whitney machine

the lever *G*, and the work then makes one complete revolution, which occupies 7 min. When required, the spindle can be turned by means of the hand-wheel *H*.

A high-speed steel cutter *J* is employed for milling the cam profile, and is of ½-in. diameter, with six helical teeth. The cutter is held in a collet in the spindle of the milling head at the right, to which motor drive has been applied by Vickers-Armstrongs, and it runs at 550 r.p.m.

ROLLER BURNISHING CAM PROFILES

As has already been mentioned, the cam profiles are finished by roller burnishing, and a close-up view of the set-up is given in Fig. 3. The operation is performed on an old Pratt & Whitney No. 10 horizontal milling machine, to which motor drive has been applied by the company. This machine has a work-table which is operated by the lever *K* and carries a simple bracket with a freely-rotating roller, made from high-speed or cast steel.

A fixture, of generally similar design to those employed for profile milling, is secured to the spindle of the machine, and a workpiece is seen at *L*. The spindle is run at a speed of 60 r.p.m., and the table is advanced by hand to hold the roller in firm contact with the cam periphery. It is arranged that after the completion of the semi-finish milling stage, the cam profiles are a maximum of 0·0005 in. (a side) larger than required, to allow for densification of the metal during rolling. Oil is applied to the profile at the start of the rolling operation, with a brush, and from 10 to 12 revolutions of the work are usually required to obtain the required finish.

DRILLING PIVOT CASTINGS

Certain petrol dispensing pumps are provided with a radial arm to carry the hose whereby the petrol is delivered. Such pumps are fitted with a casting which incorporates a central spigot, whereon are brazed brass bushes that serve as bearings for the arm. The spigot is tubular with two approximately-rectangular openings, and petrol passes up the tube and through the openings into the arm. Co-axial with the spigot, and brazed to it to ensure petrol tightness, is a length of conduit for the passage of the electrical wiring for current supply to the advertising light, when fitted.

A centre casting for the radial arm pivot assembly is seen at *M* in Fig. 4, which shows the Archdale vertical pillar drilling machine employed for the production of four $\frac{11}{16}$-in. diameter holes in the corners of the component flange, and six

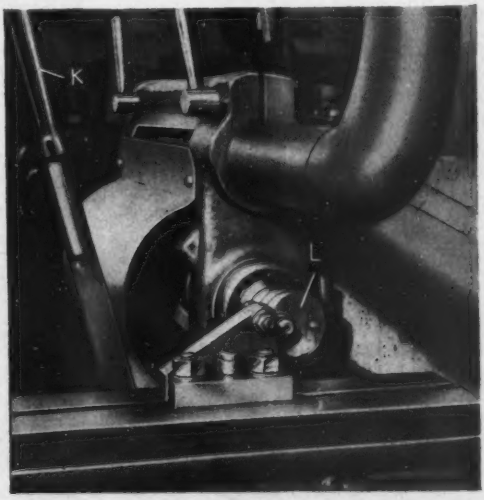


Fig. 3. The cam profile is finished by rolling on a converted horizontal milling machine

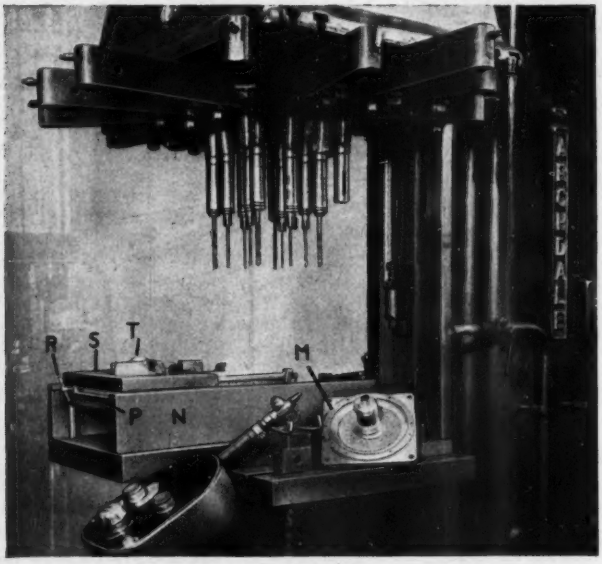


Fig. 4. Centre castings for radial arm pivots, as seen at the right, are drilled on this Archdale machine, fitted with a multi-spindle head

holes of 0·196-in. diameter through an annular rib which is concentric with the spigot. Before centre castings are delivered to the Archdale machine, the brass bushes on the spigot are turned, the flange is faced, and the annular rib is machined internally and externally to provide register diameters. The machine is fitted with a multi-spindle head, of adjustable-centre type, and all holes are drilled simultaneously.

A simple fixture is employed for the drilling operation, and to facilitate loading and unloading, it is arranged to slide in a built-up channel member *N*, secured to the table of the machine. The fixture incorporates a heavy-section steel plate *P*, supported on four short pillars, the lower ends of the pillars being arranged to slide on the surface of the base of the channel member.

For loading, the casting is inverted, and when it is placed in the fixture the spigot passes through a central clearance hole, the external register diameter engages a recess, and the machined face of the flange rests on the surface of the plate *P*. A thumb screw *R*, at one corner of the plate *P*, is then tightened, to swing the casting until the rear left-hand corner of the flange (as viewed from the front of the machine) contacts a stop pin on the fixture, which provides for angular location. With the component thus positioned, a bush plate *S* is mounted on two studs that project from the plate *P*. There are two holes in the bush plate which are a sliding fit on the plain portions of the studs, and after it has been loaded, the plate is secured by nuts.

A component can be seen at *T* projecting through the central hole in the bush plate. With loading completed and the bush plate secured, the fixture is advanced towards the machine to a position controlled by a stop. The sides of the plate *P* are a sliding fit between the vertical walls of the channel, and the fixture is finally located beneath the drills by a sliding pin at one side of the channel. For the drilling operation, the spindles

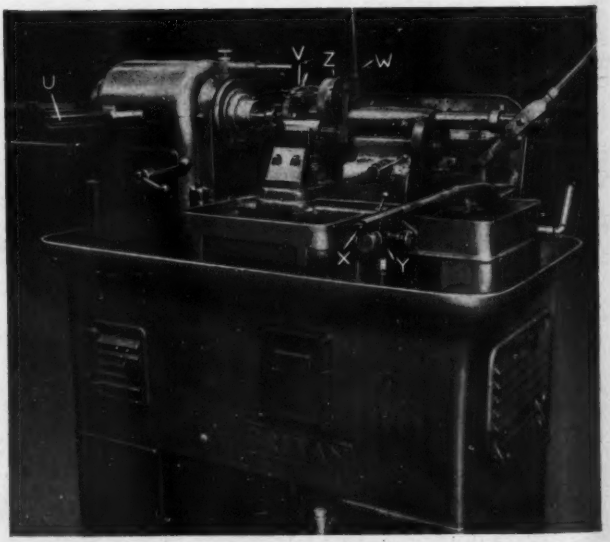


Fig. 5. One of a battery of Britan repetition lathes installed at the Crayford works of Vickers-Armstrongs (Engineers), Ltd. The machine has pneumatic bar feed arrangements, and air-hydraulic longitudinal power traverse for the rear slide

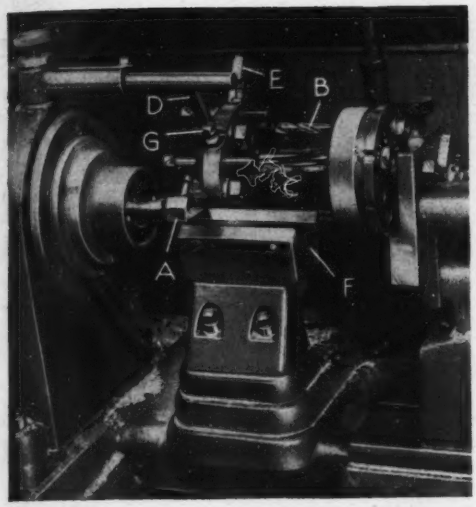


Fig. 6. Close-up view of a typical set-up on a Britan repetition lathe. A turret is mounted on a compound slide at the rear and provides for forming, longitudinal turning and similar operations. A second turret on the tailstock carries end-working tools

of the multi-head are run at 922 r.p.m., and the tools are advanced at a feed of 4 in. per min.

TURNING OPERATIONS ON BRITAN LATHE

There is a large battery of Britan repetition lathes in the main machine shop of the Crayford works, one of which is seen in Fig. 5. As many as 15 tools can be brought into use at any one set-up, and bar material up to ¾ in. diameter can be handled by the air-operated feed mechanism. Driven by V-belt from a 2-speed motor, the spindle can be run at any of eight speeds from 358 to 4,414 r.p.m. Dead-length collet chucks are used to grip the work-material, and the collet operating lever is indicated at *U*.

There is a main turret *V* on a compound slide at the rear of the bed, and the complete turret unit can be swung in the horizontal plane for turning tapers up to 10 deg. Tools are mounted radially in the turret, and may be either standard square-section bits, or drills or similar cutting tools carried in holders. Each tool is supported by a hardened and ground plate when in the cutting position, and this plate can be replaced by a former for profile turning. For each turret station there is a stop screw that projects axially from the face of the turret and engages an abutment on the headstock. A swinging stop member can be brought into use for cutting in a direction away from the headstock. The main turret is controlled by two levers, normally held in the operator's right and left hands, and one lever, seen at *W*, provides for longitudinal movement and indexing, and the other, at *X*, for transverse motion. Air-hydraulic feed is provided for the longitudinal motion, and can be engaged, as desired, by means of the lever-operated valve *Y*, which also enables the feed-rate to be adjusted.

The tailstock has two quills, either of which can be swung into the operating position. On the machine shown, an 8-station supplementary turret *Z* is fitted to one quill, and incorporates collets for end-working tools, such as drills, and tap and die holders, or stops. The second quill can be used, if required, to hold heavy-duty end-working tools or a work-support centre.

Fig. 6 is a close-up view of the set-up on the Britan lathe, which is typical of those employed in the works, and the component produced is seen in Fig. 7. This bearing bush is made from hard rolled brass rod, of $\frac{7}{16}$ in. diameter, and is produced in a cycle time of 40 sec. The sequence of operations is as follows:—(1) Feed bar to a stop mounted in the rear turret; (2) centre drill with a tool mounted in the holder A, Fig. 6, in the rear turret, using air-hydraulic feed; (3) drill 0·302 in. diameter, with a tool *B* in the tailstock turret (hand feed); (4) ream to 0·3125 in. diameter, with a tool *C* in the tailstock turret (hand feed); (5) turn 0·375/0·376 in. diameter by $\frac{3}{32}$ in. long with a tool *D* in the rear turret, using air-hydraulic feed, and with the turret locked; (6) face the small end

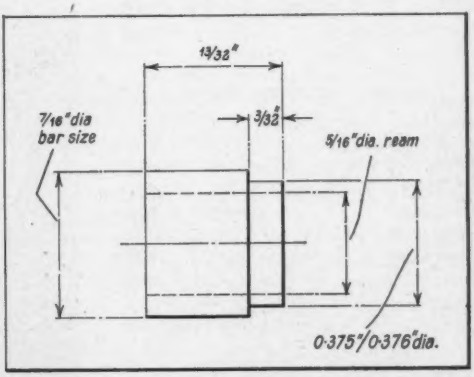


Fig. 7. Details of the brass bearing bush produced in a cycle time of 40 sec. at the set-up seen in Fig. 6

Fig. 8. Close-up view of the bench for assembling, running-in, and testing metering pumps for the petrol dispensing pumps made by Vickers-Armstrongs (Engineers), Ltd.

of the component and break the sharp corners with a tool *E* in the rear turret (hand feed); (7) groove to break the corner at the rear end of the component with a tool in the rear turret (hand feed); and (8) part off with a tool in the rear turret (hand feed).

In Fig. 6, the hardened support plate for the tools in the rear turret is indicated at *F*, and it may be observed that there are radial screws in this turret, as seen at *G*. Each radial screw engages the rear face of the support plate to control the transverse setting of the turret for the corresponding tool.

ASSEMBLY OF PETROL PUMPS

Assembly of petrol dispensing pumps is carried out in two sections of the Crayford works, and one section provides for the building of sub-assemblies. In this section there are two rows of benches, one of which serves for the assembly of the main pump, and the other, for the metering unit. When each main pump has been assembled, it is tested for lift and power consumption, and it must be capable of producing a vacuum of at least 26 in. of mercury.

One of the bench stations for the assembly of metering units is seen in Fig. 8, and units are passed to this station with the pistons, cams, and associated drive mechanism assembled, a stack of units in this condition being seen in the background. After certain other parts have been added, the complete assembly is run-in by connecting an air supply, at 5 lb. per sq. in., to the inlet through which petrol normally enters. Connection is made by means of a coupling *A*, which comprises a plate, faced with a rubber pad, and is held in position by a stirrup member and a thumb screw.

The pistons of each metering unit operate in pairs, and the travel of one piston of each pair can be restricted by an adjustable stop in the associated cylinder. Adjustment is normally effected by means of a knurled wheel on one cylinder head, and this wheel is fitted at the bench station shown. The wheel spindle is turned, with the aid of a screwdriver, until the movement of the pistons is fully restricted and the unit

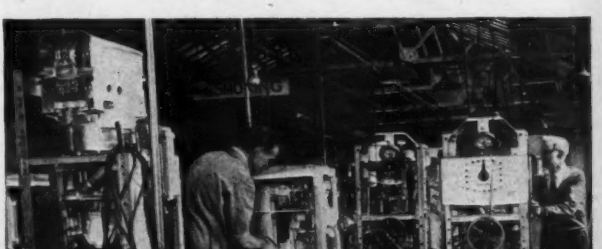


Fig. 9. The test bay on the final assembly line for petrol dispensing pumps at the Crayford works

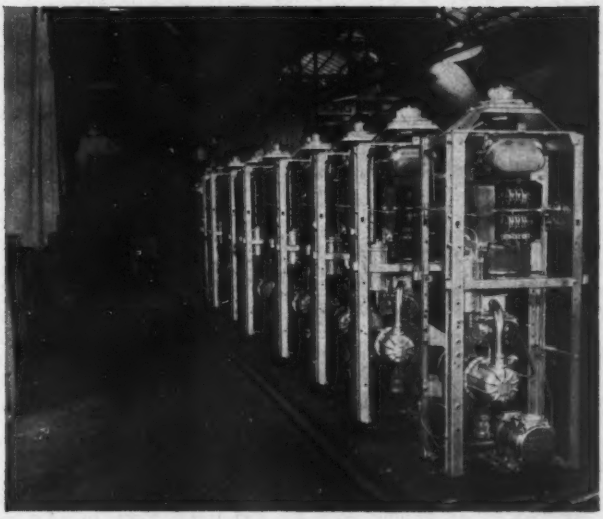


Fig. 10. Partly-completed petrol pumps, after painting, are here seen on the conveyor leading to a storage track which serves the final inspection and assembly section

stalls. A zero setting is thus established, and the spindle is next turned back through 180 deg. The wheel is then assembled, a hole is drilled through the spindle, by means of a portable electric tool, using existing holes in the wheel hub to guide the drill, and a pin is fitted.

Sub-assemblies, including the main pump and metering unit, are delivered to stations along a roller conveyor track that serves for final assembly. At the start of the assembly line, four uprights are bolted to the base, and supports for the calculator unit are secured to the uprights. The main pump and air separator unit are then fitted as a unit, followed by the top support frame with the associated interior lighting fitting. This latter sub-assembly is built at one of the bench stations along the conveyor track. Next, the motor and piping for the pre-set type of pump are assembled, followed by the calculator unit, pipework, sump, driving belt, and other details. The metering unit is assembled at one of the final stages of this section of the line, and the conveyor then slopes down to the test bay seen in Fig. 9.

Each petrol pump is tested by delivering a specific quantity of odourless kerosene, and checking the reading of the indicator dial. Board of Trade regulations lay down that the test volume shall be 5 gal. or 20 litres, and that the delivery must be correct within a tolerance of -0, $+1$ fluid oz. per gal. The necessary adjustments are made to the metering pump, and the power consumption of the drive motor is checked, to determine whether there are any faults in the complete assembly. Any units that require rectification are transferred to a length of roller conveyor track, parallel to the main line, whereon they are returned to the appropriate assembly stations.

From the test bay, the main roller conveyor track makes a double curve, so that it is S-shaped in plan. The track passes first through a large spray booth, wherein aluminium paint is applied to most of the interior surfaces, certain areas being masked, however, to prevent clogging of the mechanism. This large booth also serves for applying primer coat to small components for the casing. The second curve of the S-shaped track is adjacent to a smaller spray booth, employed for finishing the casing members, and this booth may be seen in the background in Fig. 10. From the second curve the track follows a straight path, and finish-painted, partly-completed pumps are seen on this run of conveyor in the illustration. To the left is an overhead conveyor, with a floor-mounted rack below, which provide for drying the casing components.

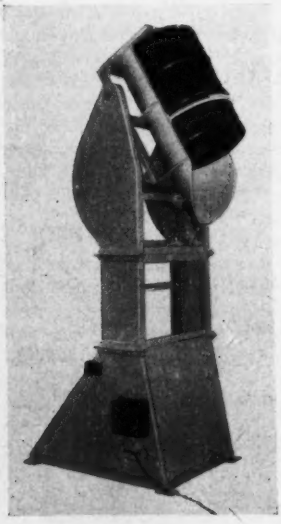
Casing side panels and canopies are fitted to the pump assemblies in the position seen in Fig. 10, and the units are then moved along the conveyor track, which curves through 90 deg. to a straight run that provides for storage. From this run of conveyor, the units are moved on to another straight run, at 90 deg. to the first, which serves for final inspection and certain assembly operations. The firm of Gilbarco, Ltd., for whom the pumps are built, supply the advertising and facia panels, also the dials for pumps which are to be exported, and these components are fitted to the basic pump assembly by the inspector, since he would have to remove them to carry out his duties were they added at an earlier stage. Each pump carries a label which informs the inspector of such details as colour, electrical supply, currency and motor, for example. There are as many as 90 possible variants of the basic pump design to suit different operating conditions and locations. In this section, moreover, the glass panels are fitted to the casing, to complete the assembly operations. From the inspection conveyor, the

finished pumps are passed to an adjacent store, by means of a Diamatic fork-lift truck, and are packed in crates, in readiness for transport by road or rail.

Other activities at the Vickers-Armstrongs (Engineers) works at Crayford, Kent, will be considered in subsequent articles which are to be published shortly in MACHINERY.

Russell Hi-Tip Lifting and Tipping Unit

To provide for lifting and emptying various types of containers, Russell Constructions, Ltd., Russell House, Adam Street, London, W.C.2, have developed the unit here illustrated, which will lift a container with a maximum weight of 10 cwt., and tip it so as to empty the contents into a hopper, truck, mixer, or other receptacle. This unit, known as the Hi-Tip, has a minimum height of tip, of 4 ft. 6 in., which can be readily increased to any height that may be required by the addition of extra centre sections between the top and bottom units.



Russell Hi-Tip lifting and tipping unit for charging hoppers

The welded frame comprises a base, a top unit, and the centre sections. The base houses the control mechanism, and the main drive for the carriage to which the container to be emptied is clamped, and the top unit incorporates the cam guides which produce the tipping action.

Drive is taken from an electric motor provided with a self-contained brake, and the carriage is elevated by means of two Renold chains and associated sprockets. Automatic stop switches are fitted at the loading and tipping positions, and there is an overload switch for the motor. The start and return motions are normally controlled manually, but automatic sequence control can be provided if required, the emptying time being determined by an adjustable time switch. Speed of lift is 30 ft. per min., and the standard tipping angle is 30 deg. from the vertical.

Londex PS/MIN Miniature Pressure Switch

Londex, Ltd., Anerley Works, London, S.E.20, have recently added to their range the PS/MIN miniature pressure switch shown in the figure. Single-pole, snap-action, silver change-over contacts are normally incorporated, which are rated up to 5 and 2 amp. at maximum voltages of 250 a.c. and 30 d.c., respectively, but an alternative type with double-pole contacts can also be supplied.

Londex PS/MIN miniature pressure switch

The unit is intended for use with non-corrosive gases and liquids at temperatures up to 100 deg. C., and can be supplied for maximum pressures of 200, 300, and 350 lb. per sq. in. Each switch is normally pre-set for the contacts to be operated at a specified rising or falling pressure, within ranges of 10 to 30, 15 to 80 and 55 to 180 lb. per sq. in., respectively, but adjustment is provided and the operating point can be altered if desired. The differential between the pressures at which the contacts are operated and re-set depends on the working range, and varies from 1½ to 2½, 3 to 5, and 6 to 14 lb. per sq. in. A seamless phosphor bronze bellows forms the pressure-sensing element. The male inlet connection at the lower end of the nickel-plated brass body can be threaded ⅜ or ¼ B.S.P.

ELECTRIC AND DIESEL-ELECTRIC LOCOMOTIVES added to British Transport Commission stock during the first quarter of this year totalled 148, and 88 locomotives were exported. Corresponding figures for the quarter in 1960 were 159 and 97.

Some Engineering Applications of Nitrogen*

Apart from its uses as a constituent of many manufactured chemical compounds, nitrogen has a wide variety of applications on account of its special properties. It is prepared on a large scale, to meet current industrial requirements, almost entirely by fractional distillation of liquid air. Since the boiling point of nitrogen—namely −196 deg. C.—is lower than that of oxygen, it tends to evaporate first, leaving the oxygen behind, still in liquid form. The British Oxygen Co., Ltd., are among the largest producers of nitrogen in the country, and some of the engineering applications are here discussed.

SPECIAL STAINLESS STEEL

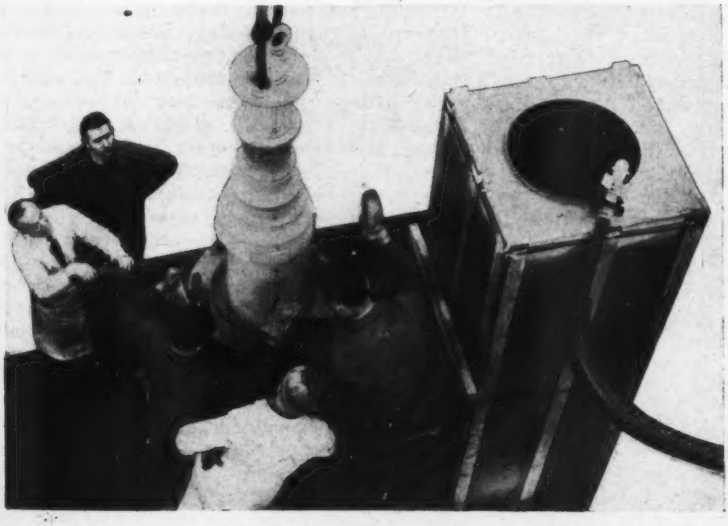
Striking changes take place in the properties of certain stainless steels when they are worked at the temperature of liquid nitrogen. In a typical process, the steel is heated to 1,149 deg. C. for a short time, quenched in water, cooled with liquid nitrogen to −196 deg. C., and rolled at this temperature from a thickness of ¼ to $\frac{1}{16}$ in. Finally, it is aged for several hours at 399 deg. C. It is claimed that stainless steel prepared in this way acquires unusual hardness and that cutlery made from it does not require resharpening for three years.

SHRINK FITTING

With this technique, the part which is to be fitted into another is cooled in liquid nitrogen, and inserted in its mating housing while still cold and contracted. An advantage of this procedure, apart from obviating the need for heavy pressing equipment, is that since no heating is required, there is less risk of altering the metallurgical condition of the metal forming the housing, which may have been carefully heat-treated during manufacture.

An interesting example of cold shrink fitting is shown in the accompanying illustration. Here, one of 12 shafts of 13 in. diameter, for large, high-speed, squirrel-cage induction motors, supplied by Lancashire Dynamo & Crypto, Ltd., for Bradwell nuclear power station, is being fitted into the rotor. The 9 ft. long shafts were shrunk in liquid nitrogen by 0·023 in. on diameter, over a length extending for approximately 50 in.

* Abstracted from an article published in the Spring, 1961, issue of *Torch*, the quarterly technical bulletin of the British Oxygen Co., Ltd.



Fitting a 13-in. diameter motor shaft, which has been shrunk with liquid nitrogen, into its rotor, at the works of Lancashire Dynamo & Crypto, Ltd.

DEGASSING NON-FERROUS METALS

It has been shown that hydrogen is the principal cause of porosity in castings of aluminium and copper, and their alloys. Hydrogen in the metal may be derived from the combustion products in the furnace and from atmospheric moisture, also from oil on scrap or other hydrocarbons introduced into the furnace. There are, of course, many other factors which affect the degree of gas porosity in cast metal, and a number of other gaseous impurities which may be present. Undoubtedly,

however, hydrogen is the contaminant which causes the most trouble.

If an inert gas such as nitrogen is introduced near the base of the crucible or ladle, it will bubble up through the molten metal, causing agitation and allowing entrapped gas bubbles to agglomerate and escape. Castings made from metal degassed in this manner show increases in specific gravity and in tensile strength, and in the case of copper, the electrical conductivity is improved.

For this application, the accepted nitrogen flow rate is 1 to 3 cu. ft. per min., and the consumption is 25 to 30 cu. ft. per ton of melt, depending upon the degree of degassification desired. Nitrogen pressure at the regulator outlet requires to be in the region of 4 to 6 lb. per sq. in. The degassing time depends on the volume of metal involved, but at the pressure and flow rates quoted, is normally between 5 and 10 min.

DE-SULPHURIZING

Sulphur is an undesirable impurity in iron, steel, and some non-ferrous alloys intended for casting. A high sulphur content is liable to result in defects in castings and to lower their mechanical properties. Coke, oil, and gases are all liable to transfer a certain amount of sulphur to the metals with which they come in contact, and since scrap metal is continually re-melted as a proportion of the furnace charges in iron foundries, the sulphur content may tend to increase progressively.

De-sulphurization can be achieved by injecting calcium carbide into the melt by means of a stream of nitrogen passing through a graphite lance. In this manner, sulphur can be removed to any desired extent. The time required to treat the metal is only 1 to 2 min., during which the ascending carbide particles react with the sulphur. A dry, easily-removable slag consisting mainly of unfused lime is produced, and the inert nitrogen has no adverse effect on the melt. There is, indeed, some evidence to suggest that an improvement in the mechanical properties results from the refining of the iron structure.

RE-CARBURIZING

The carbon content of cast iron has an important influence on its mechanical properties, shrinkage, fluidity and machinability. A carbon content of 3·3 to 3·8 per cent is necessary to ensure good foundry and machining properties, and it is clearly of advantage to be able to melt the cheapest material which may be available at any given time, and then to add the required amount of carbon.

For this purpose, graphite is injected into the melt through a graphite lance, with the aid of a stream of nitrogen. Normally, this process is used for treating iron which has an initial carbon content of 3 per cent. A final carbon content up to 4 per cent can thus be obtained quite rapidly, the efficiency of carbon pick-up being high.

SUPERCONDUCTIVITY

Another application of potential importance is concerned with the phenomenon of superconductivity, which is exhibited by some metals, electrical conductivity being greatly increased at very low temperatures. While most apparent at the temperatures of liquid hydrogen and liquid helium, the effect can also be of significance at liquid nitrogen temperature. Figures recently published show that the resistance of two coils amounted to 26 milli-ohms at room temperature, 3 milli-ohms at the temperature of liquid nitrogen, and 0·12 milli-ohms at that of liquid hydrogen.

As a cold liquid for traps for protecting vacuum systems, liquid nitrogen is already in use on an industrial scale in the U.S.A., where very large quantities—more than 110 million cu. ft. per month—are also being employed in connection with the separation of uranium isotopes.

Underground Instrument Factory

The Brunson Instrument Co., U.S.A., makers of high-precision optical tooling and surveying instruments, has recently completed the transfer of its manufacturing plant and associated office facilities to an underground factory on the outskirts of Kansas City. Six tunnels, each 30 ft. wide by 525 ft. long, have been cut into solid limestone, on a centre distance of 45 ft. Cross tunnels, each 30 ft. wide, have been cut on a centre distance of 90 ft. The ceiling height throughout is about 12 ft.

Originally, the site of the present plant was a limestone quarry, and the sale of the excavated rock offset about two-thirds of the cost of the plant, excluding the price of the land. Overall cost of the plant was about half that of a conventional factory, and because of the reduced fire risks, insurance rates are only about one-fourteenth of those normally charged.

Complete air conditioning is provided, principally to reduce humidity, and all incoming air is filtered to remove moisture. Walls and ceilings are treated with sealing compound to eliminate dust. Since the machines are now mounted on solid rock foundations, vibration is no longer a problem in connection with precision machining and testing.

DIE CASTING SUPPLEMENT

Pressure Die Cast Aluminium Cylinder Blocks*

Some Aspects of Design and Production

WITH THE PRIMARY OBJECT of reducing engine weight, whilst maintaining previously established levels of life, performance, and cost, the Chrysler Corporation, U.S.A., began limited production, for some of their 1961 motor cars, of an engine with a pressure die cast aluminium block. Compared with a conventional cast iron block, the new unit has permitted a reduction in weight of 76 lb., and a further saving of 15 lb. has been achieved by the substitution of an alternator for a d.c. generator and die cast aluminium oil and water pumps. The new engine has a displacement of 225 cu. in., and has six cylinders in line, the bore and stroke being 3·40 in. diameter and 4·12 in., respectively. Compression ratio is 8·2 to 1, to enable standard grade fuel to be used.

Apart from the new block, and other items mentioned above, the engine is basically similar to the 1960 version, and incorporates the same type of cast-iron cylinder head. A cast-iron intake manifold is employed, however, instead of the aluminium unit used for the 1960 engine, since it was found that by making this change certain manufacturing costs could be reduced. It may be noted that a basically similar 6-cylinder engine of 170-cu. in. displacement is also made, with a die cast block which has bores of the same size (3·40 in. dia-

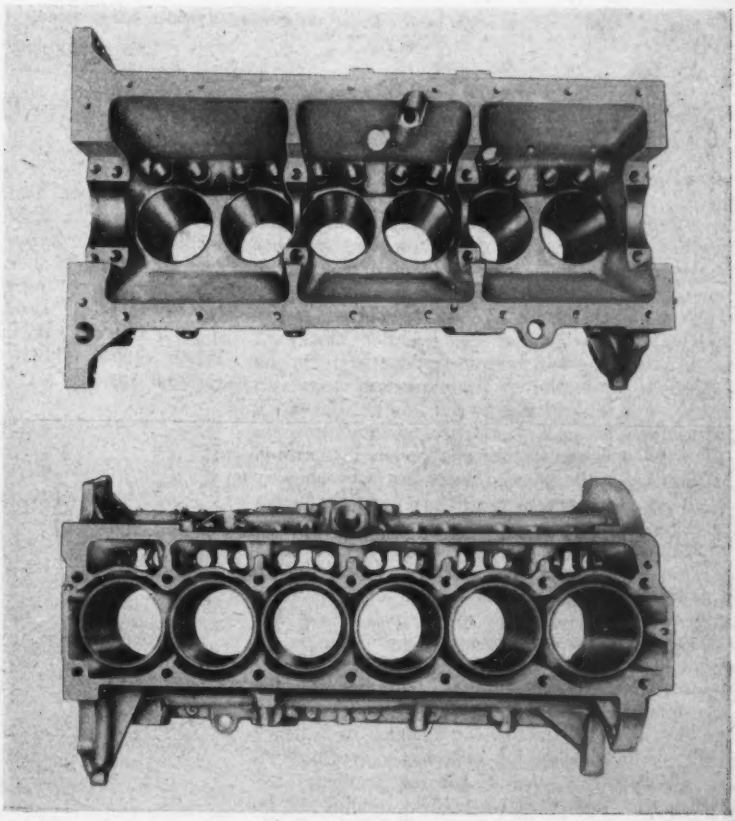


Fig. 1. Under-side and plan views of the Chrysler 1961 design of 6-cylinder, in-line, die cast aluminium block

* Abstracted from two papers read at the 1961 SAE International Congress and Exposition of Automotive Engineering, held in Detroit, Michigan, U.S.A., from January 9 to 13, 1961. (*Chrysler Corporation's Die Cast Aluminum Slant Six Engine*, by E. G. Moeller, W. L. Weertman and H. E. Eriksen. *The American Motors New Die Cast Aluminum Engine*, by J. F. Adamson, C. E. Burke, D. V. Potter and W. J. Zechel.)

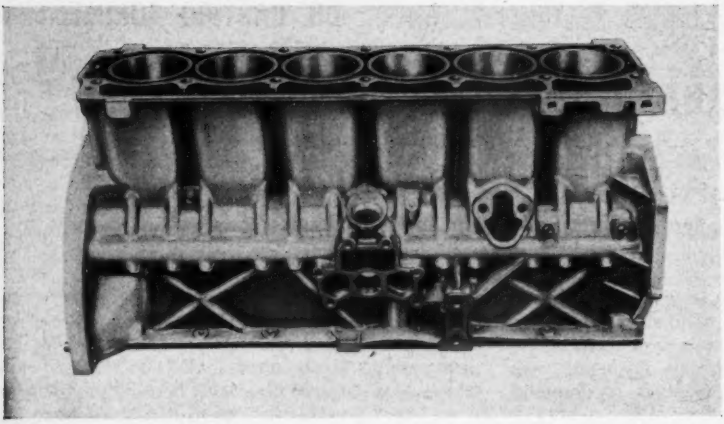


Fig. 2. View from the right-hand side of the die cast cylinder block seen in Fig. 1

meter) but is designed for a stroke of 3·12 in.

The engine incorporates integrally-cast iron liners, as it was considered that this arrangement offered certain advantages in respect of quality control, and economy and speed of production as compared with the use of replaceable liners. Previous experience in connection with another design of engine influenced the decision to employ 2-piece cast-iron main bearings which are secured to the engine block by screws. In Fig. 1, under-side and plan views of the cylinder block are shown at the top and bottom respectively. In the under-side view, the three crank-case bays can clearly be seen, and the portion of the die which forms these areas also supports six mandrels on which the cylinder sleeves are loaded for casting. This portion of the die also forms the tappet bosses, which are cored out, as are the end bearing bosses for the camshaft.

Referring to the plan view of the block (below in Fig. 1), it may be noted that the cores which form the tappet chambers—also the water jacket core—are mounted on the ejector half of the die. The combined thickness of cast-iron and aluminium which forms the cylinder wall is 0·21 in., and the minimum water jacket space, in the areas between adjacent cylinders, is 0·16 in. It may be noted that the small thicknesses and spacing are a direct result of maintaining the cylinder centres at 3·98 in., which is the same as for the previous cast-iron engine and enabled existing tooling to be employed. A general view of the right-hand side of the block is given in Fig. 2, where it can be seen that the walls of the tappet chambers are cored into the wall of the water jacket below the bosses for the cylinder head screws. Various faces on this side of the block serve for mounting the oil and fuel pumps, also the distributor.

One half of the water pump housing is cast integral with the right-hand end face of the block, as viewed in Fig. 2, and the outlet from the scroll portion of this housing leads directly into the lower portion of the water jacket. The flange seen at the right in this figure is part of the timing chain case.

THE CYLINDER LINERS

As mentioned earlier, the engine incorporates integrally-cast iron cylinder liners, and it may be noted that when loaded into the die these components have a wall thickness of 0·10 in. A section through a typical cylinder, with the liner cast in position, is shown in Fig. 3. The aluminium which surrounds the liner has a minimum thickness at the top (namely, 0·11 in.) as a result of the 0·5 deg. draft on the core for the water jacket. When the aluminium is cast around the liner, residual stresses are set up in the former as a

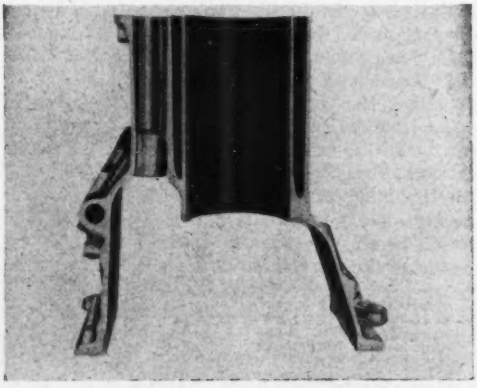


Fig. 3. Typical section through a cylinder bore of the Chrysler die cast block, showing the integrally-cast iron liner

result of the difference in contraction of the two materials. To reduce these stresses to an acceptable value—of the order of 10,000 lb. per sq. in.—the liners are pre-heated to approximately 600 deg. F. before being loaded on to the mandrels. The relative thicknesses of the cast iron and the surrounding aluminium were determined on the basis of the following factors. Variations in the as-cast position of a liner are such that, after the cylinder has been bored, the walls of the liner may vary in thickness by 0·030 in. Allowance must be made for the removal of 0·020 in. per side from the bore of each liner, during machining, and consideration must be given to the fact that below a certain thickness of aluminium it is difficult to ensure sound castings, also to maintain the residual stresses mentioned above within acceptable values.

Any attempt to reduce the thickness of the water jacket core at the top of the cylinder to less than 0·16 in. (in order to increase the thickness of the surrounding aluminium) was liable to reduce the life of that portion of the die to an unacceptable value. For these reasons, it was decided to employ 0·10-in. thick cast iron liners and 0·11-in. thick aluminium walls, as already indicated, and this combination has proved completely satisfactory under stress analysis and fatigue testing, as well as dynamometer and running tests.

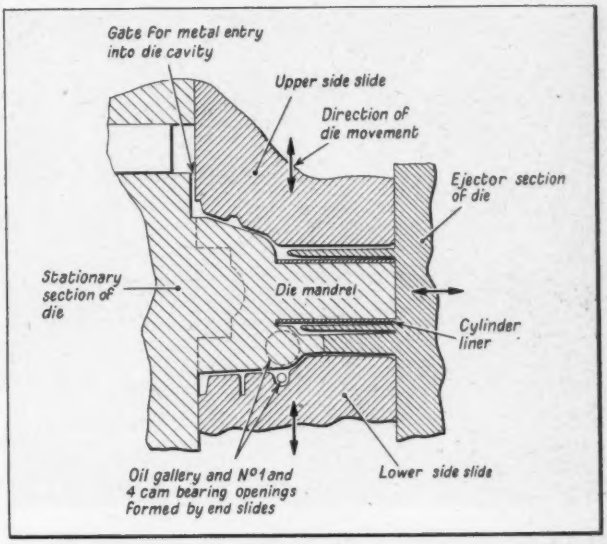

Gate For metal entry into die cavity
Upper side slide
Direction of die movement
Ejector section of die
Stationary section of die
Die mandrel
Cylinder liner
Oil gallery and N°1 and 4 cam bearing openings Formed by end slides
Lower side slide

Fig. 4. Diagrammatic section through the dies for pressure casting the Chrysler 6-cylinder engine block. A cast iron cylinder liner is indicated in position on one of the mandrels

THREADED FASTENINGS

In recent years, considerable laboratory work has been carried out in connection with the physical properties of die cast aluminium in relation to threaded fastenings. Certain general results have been established, including the following: the strength of a thread in a boss can exceed the strength of the shank of an associated high-tensile steel cap screw provided the length of thread engagement in the aluminium is not less than 2½ times the diameter of the screw; the area of aluminium required to withstand the compressive load of the fastener should normally be based on a yield value of 10,000 lb. per sq. in., although in some instances a value of 15,000 lb. per sq. in. may be employed. As is well-known, hoop stresses of a high order are developed by the reactions between the flanks of screw threads, and in some instances, where it is desired to utilize the full strength of high-tensile screws, it is necessary to employ buttress-type threads. Owing to the lower hardness of aluminium compared with cast iron, there is a greater tendency for cross-threading and galling to occur when screws are being assembled. Consequently, the frequency of failure of threads in aluminium is slightly greater than in cast iron. Several types of inserts are, however, commercially available, whereby effective repairs to damaged tapped holes can be made.

With the Chrysler aluminium engine, the screws which secure the head to the block are of ⅜-in. diameter with 14 t.p.i., and 60-deg. thread form. They are tightened to a torque of 65 lb.-ft., which provides an axial load of approximately 10,000 lb. The screws which secure the main bearing caps are of ½ in. diameter, with 13 t.p.i. and 60-deg. thread form, and are tightened to a torque load of 50 lb.-ft., to produce an axial force of approximately 7,500 lb.

ASPECTS OF DIE DESIGN

Experience of die casting components as large as the 6-cylinder block here described was very limited, although knowledge gained in the design and production of die cast torque converter housings, a combination transmission case and

Fig. 5. In this view of the stationary half of the die, the 6-cylinder liner mandrels on which the cast iron liners are loaded can be clearly seen at the centre

housing, and wheel brake drums, proved useful. A diagrammatic section through the cylinder block die is shown in Fig. 4, where a cylinder bore mandrel is indicated, with a liner in position. It will be noted that the crankcase core, and the liner mandrels, are secured to the stationary portion of the tool, and the sides of the block—also the cored out portions of the head face—are formed by fixed and moving cores on the movable portion of the tool. All moving cores which are inclined to the direction of die opening, or of the main core slide movements, are pulled by hydraulic cylinders, and similar units are also employed to withdraw the cores for the oil gallery holes, which require a 13-in. pull. The complete die assembly weighs 44,000 lb., and it measures 83 in. wide by 60 in. high by 49 in. thick.

In Fig. 5 is shown the stationary half of the die, and the six cylinder liner mandrels can be clearly seen at the centre. The ejector half of the tool, with the core slides assembled, is shown in Fig. 6. This die is operated on a special 2,000-ton die casting machine, which was designed to withstand a metal pressure of 8,000 lb. per sq. in. In order to maintain such a pressure in the die, also to ensure complete filling of the cavity and a rapid cycle, eleven accumulator bottles are provided, and 5-in. diameter bore hydraulic piping is employed. The blocks are made from SAE No. 303 aluminium die casting alloy, containing 3 to 4·5 per cent copper and 10·5 to 12 per cent silicon. Among the most difficult dimensional limits to maintain are those on the centres of the cylinder bores in the as-cast condition, namely ±0·015 in.

ECONOMIES IN MACHINING

Advantages from the use of aluminium alloy for the cylinder blocks are also obtained in the subsequent machining, since increased feed rates and spindle speeds can be employed as compared with those suitable for cast iron, and cutter life is greater. In general, cutting times are reduced by approximately 50 per cent, and a typical saving is that obtained in connection with the semi-finish machining of the pad to which the oil pump is secured. For the cast iron block, this milling operation is carried out with a 4¾-in. diameter cutter, running at 136 r.p.m., and with

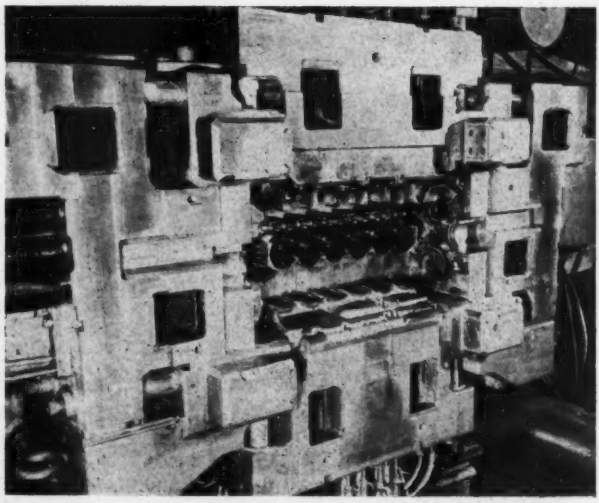


Fig. 6. The ejector half of the die with the side slides assembled

a feed rate of 28·7 in. per min., the time required being 18 sec. On the aluminium block, however, the same pad is machined in only 10 sec., the feed rate being increased to 50·8 in. per min. and the spindle speed to 255 r.p.m.

Another operation provides for drilling a ¼-in. diameter hole to a depth of 1·92 in., for an oil feed passage, and with the cast iron block this operation requires a drilling time of 22 sec. For the aluminium die cast block, however, the drilling time for this hole from the solid is only 11 sec.

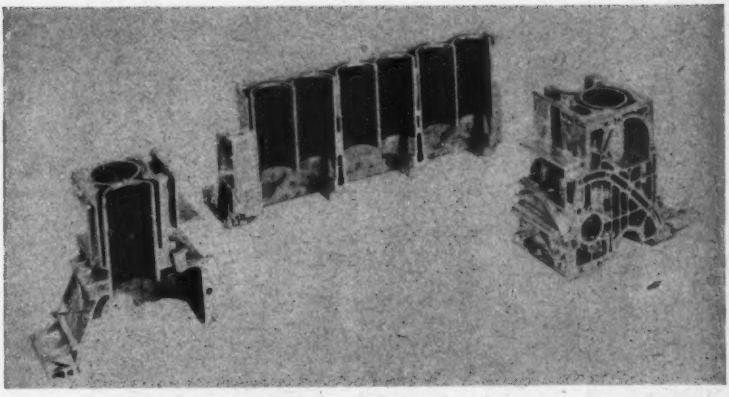


Fig. 7. Three sections of the die cast block for the American Motors A-type block, which was built in fairly large numbers in order to gain experience of the techniques required

For milling the oil pump pad mentioned above, it was necessary to change the cutter after every 2,800 pieces when cast iron blocks were being machined, whereas for aluminium blocks the cutter life is 13,400 pieces. Similarly, the drill employed for the oil passage mentioned above required sharpening after every 800 cast iron blocks, but in aluminium the drill life is of the order of 3,000 pieces.

Finally, mention may be made of a combined saving in material and machining which has been achieved in connection with the ⅝-in. diameter main oil gallery. In the cast iron block, this gallery requires to be drilled from the solid, but in the die cast block it is cored to the required size, and machining has been completely eliminated.

THE AMERICAN MOTORS 6-CYLINDER RAMBLER ENGINE

Engines with die cast aluminium cylinder blocks were put into production by American Motors Corporation, U.S.A., in two stages. As a first step it was decided to build a fairly large number of engines with blocks of a design which could be machined with equipment which was already available, and had previously been employed for operations on a cast iron block. This aluminium-block engine, which was known as type A, was intended for experimental purposes, to enable various aspects of the designs of both the product and the die casting die to be investigated. It also provided an opportunity for the tooling, production, and service departments to become familiar with the characteristics of a different material, and with the associated manufacturing techniques. Subsequently, as a result of the experience gained with the A-type engine, another design—known as the B-type—was developed by the company.

Some of the aspects on which information was required could be investigated in connection with sand cast aluminium cylinder blocks, and castings were made and tested while the die casting equipment was being developed. For the sand castings, a special alloy known as Silumin Gamma was employed and the castings were supplied by the Honsel-Werke foundry in Germany. Silumina Gamma alloy was selected because it closely resembles the ASTM 12A die casting alloy which was subsequently used for the die cast blocks. Three sectioned portions of an A-type engine are shown in Fig. 7, and it will be noted that it has "free-standing" cylinler barrels. Support is provided by small webs, which extend between the peripheries of adjacent barrels, and between the barrels and the walls of the water jacket. The later—B-type—engine also incorporates free-standing cylinders of this type.

In connection with the development of the die casting techniques required for the new engine, the company co-operated closely with the Doehler-Jarvis Division of National Lead Company, U.S.A., since in 1951 the latter firm had successfully produced a 4-cylinder in-line die cast cylinder block. Moreover, in 1954, Doehler-Jarvis had built a 2,000-ton die casting machine, intended for pro-

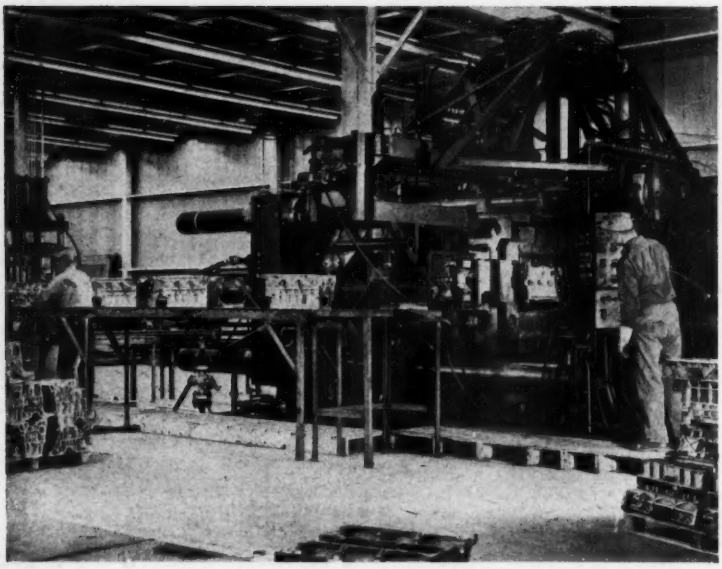


Fig. 8. The 2,000-ton die casting machine, designed and built by the Doehler-Jarvis Division of National Lead Company, U.S.A., on which the A-type blocks seen in Fig. 7 were produced

ducing a 6-cylinder wet-liner die cast block. The machine which was subsequently built for the American Motors A-type block is shown in Fig. 8, and is also of 2,000 tons capacity. It provides for injecting 65 lb. of molten metal, at a pressure of 8,000 lb., in less than 1 sec., and the die remains closed for approximately 30 sec. Nine inserts, comprising six cylinder liners, two camshaft bearings, and an oil gallery tube (used only in the A-type engine), are automatically loaded into the die. Automatic unloading equipment for the casting is also provided and the longest stage in the production cycle is devoted to cleaning the die after each shot.

CENTRIFUGALLY-CAST CYLINDER LINERS

Tests were carried out with three different types of cylinder liners, namely, liners sprayed with Metcoloy No. 2 stainless steel, liners of hypereutectic aluminium, and liners of centrifugally cast iron. The latter type, with the outer surface left rough, proved the most suitable for incorporation in a die cast block, and a complete and a sectioned iron liner are shown in Fig. 9. An indication of the excellent bond which is obtained between the cast iron and the aluminium is afforded by the macrograph reproduced in Fig. 10.

The liners are designated BMI, which stands for bi-metallic-interlock, this name having been adopted by Doehler - Jarvis. Liners are produced in a steel mould which is rotated and heated, and the interior is automatically covered with a fine coating of ceramic slurry a few seconds before the molten iron is introduced. As the slurry contacts the heated mould, the water which it contains is evaporated, leaving small voids. As the molten iron is introduced, the centrifugal force ensures that these voids are filled with metal, and the liner is thus formed with the required rough external surface. The ceramic coating in the mould also acts as a parting agent, and is stated to facilitate removal of the liner when it has cooled.

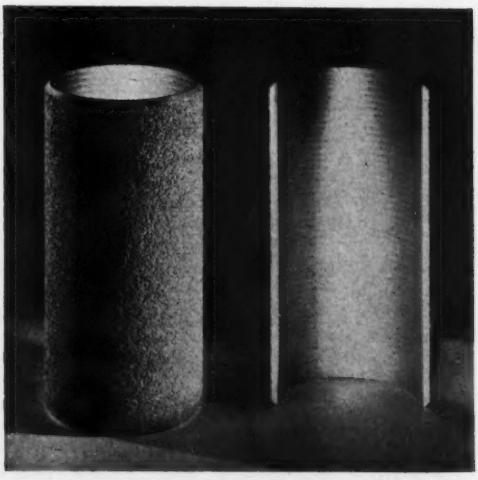


Fig. 9. Complete and sectioned centrifugally-cast iron cylinder liners of the type used in the American Motors A- and B-type die cast blocks

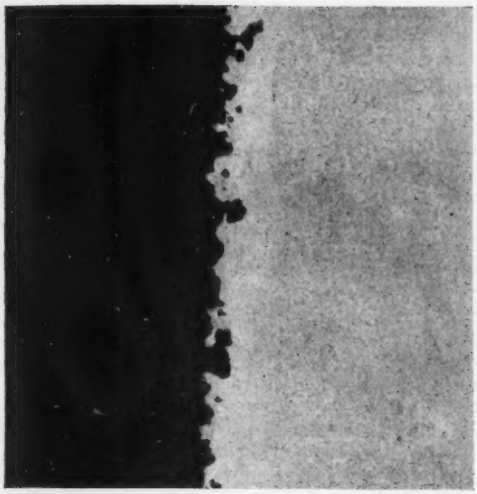


Fig. 10. Macrograph showing the bond between the cast iron liner and the aluminium block. The mould for the liner is coated with a ceramic slurry, to provide a rough external surface

Subsequently, the liners are lightly sand-blasted, to remove any residual ceramic coating, and are pre-heated in a gas-fired furnace before they are loaded into the casting die. BMI liners have a shear strength of 18,000 lb. per sq. in. at the bond face with the aluminium, and no separation between the two materials can be detected even when the aluminium is heated almost to melting point. After they have been machined, the liners have a wall thickness of 0·093 in.

DESIGN OF THE WATER JACKET

In the first experimental design of aluminium cylinder block, which was produced by sand casting as mentioned previously, the depth of the water jacket was limited to 3½ in. (from the head face), since it was thought necessary to avoid excessively long and thin core projections on the steel die which would later be employed. Dynamometer tests on early A-type machines, however, indicated that the water jacket was too shallow and in subsequent sand cast blocks this portion was deepened to 5½ in. Moreover, no great difficulty was experienced in producing core recesses to this depth by die casting.

THE B-TYPE ENGINE

From the experience gained with numerous A-type engines, the block for the B-type engine was developed, and a general view of the die casting for this later design is given in Fig. 11. On this block, the crankcase skirt is deeper, to ensure greater rigidity of the main bearings, and the overall stiffness, and the support for the transmission, were also improved. A different bolt spacing for the cylinder head was adopted, to allow the cores which form the deep water jacket pockets to be thickened and strengthened. It was also ensured that all machined surfaces on the block were either parallel, or mutually at right-angles (with the single exception of the boss to which the distributor is secured) and with this arrangement the tooling required was greatly simplified.

The capacity of the oil-pump used for the B-type engine is 40 per cent greater than that for the equivalent cast-iron engine, to ensure an adequate supply of oil for all bearings and for the hydraulic tappets which compensate for the difference in expansion between the block and the push rods. In addition, a new crankshaft was designed, which incorporates nine counterweights, and provides improved engine balance with reduced load

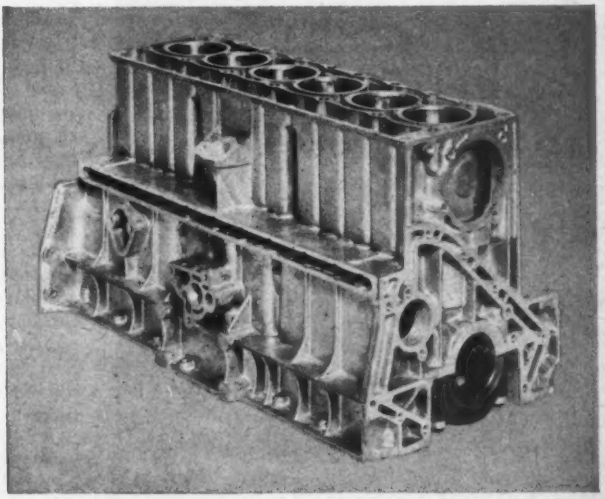


Fig. 11. General view of the B-type block, which was developed as a result of experience gained in the production of the A-type block

on the main bearings. The block for the B-type engine in the cast and trimmed condition weighs 67 lb., of which the cast-iron cylinder liners account for 14 lb. When fully machined, and with the bearing caps assembled, the block weighs 70·9 lb. For comparison, it may be noted that the 1960 design of cast-iron block, in the corresponding condition, weighs 142 lb.

A number of different designs for the main bearings was investigated, including the use of aluminium caps and aluminium caps incorporating cast-iron inserts, but none proved satisfactory. With the design finally adopted, a conventional cast-iron half cap is bolted directly to the die casting.

TESTING FOR FAILURE BY FATIGUE

In connection with investigations into the fatigue life characteristics of the aluminium block, difficulties were experienced in determining the areas of maximum stress concentrations. It was pointed out by the Doehler-Jarvis Division that the photostress stress analysis technique had a number of advantages to offer. With this method, the block to be stress analysed is coated with a special transparent plastics, and is then loaded statically, by the assembly of the cylinder head and other associated components, and dynamically by an engine dynamometer.

The plastics is secured to the block with a special reflective cement, and is viewed through a polariscope. When the plastics skin is under stress it becomes bi-refringent, and the incident polarized light is divided into two beams which travel through it at different speeds. In the instrument, the area being viewed appears as a pattern of black and coloured fringes, and by interpreting this pattern, both the magnitudes and directions of the stresses present in the workpiece being tested can be determined.

Activities of David Brown Industries

David Brown Industries, Ltd., Park Works, Huddersfield, inform us that all departments are busy with orders for the wide variety of products covered.

The General Gear Division, for gearing of the heavier types, reports an unparalleled demand, particularly for heavy helical gear units. There is also a heavy demand for high-speed turbine gears and gear units, and rail traction gear drives. Increased production of Roloid gear pumps is also reported. The 150-in. turbine gear hobbing machine equipped with electronic accuracy control equipment, which was shown at the Machine Tool Exhibition, Olympia, last year, has been installed in the works and is in production.

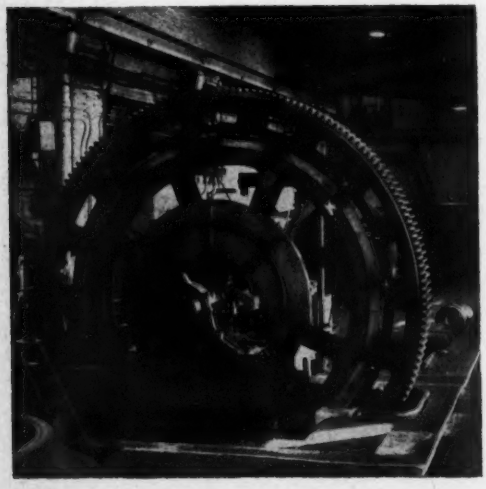


Fig. 1. An 18-ft. diameter driving gear for a cement kiln is here seen set up on a Sunderland gear planer in the Salford works of the David Brown Jackson Division

In the Radicon Division output of all types of Radicon worm reduction units is being gradually raised to meet the steadily increasing call. We are informed that the new single reduction units, at present ranging up to 8-in. centres, have been very well received and are in full production. Additions to this range will be made in the near future.

Keighley Gear Division reports a steady flow of orders for the complete machining of gears to customers' requirements, and for cutting teeth in customers' blanks. This division also makes and carries a range of stock gears for which there is a regular demand. The extensions to these works are being equipped with machine tools for producing spur and helical gears ranging up to 7 ft. diameter.

A high rate of production of gearboxes and rear axle gears for the commercial vehicle industry is being maintained by the Vehicle Gear Division, particularly for 5 and 6 speed units.

Jackson Division is busy producing heavy-duty gearing for use in various industries and is

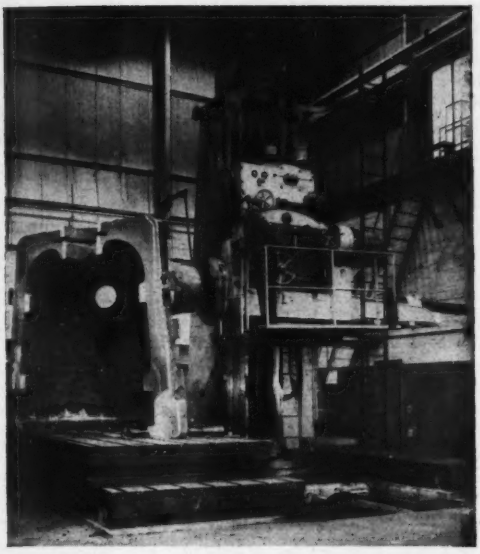


Fig. 2. A 10-ton casting which will form part of the outer casing for a high pressure turbine is here shown set up for rough machining before despatch from the works of the David Brown Foundries Division

equipped to make gears up to a maximum diameter of 36 ft. Increased gear hobbing capacity now extends to 32 ft. diameter. A Sunderland planing machine with a capacity for spur and double-helical gears up to 18-ft. maximum diameter has recently been added to the plant, and in Fig. 1 a 178-tooth by 18-ft. diameter gear is shown set up on this machine.

The Tool Division is fully occupied with the production of David Brown floating reamers and gear cutting tools, and we understand that there is a very satisfactory demand for gear measuring instruments.

The Machine Tool Division is busy with the production of all sizes of gear hobbing machines. No. 10 Hydrax high production machines account for a large proportion of the smaller sizes now on order and there is a good demand for automatic loading equipment for use with these machines. This division is particularly busy with the construction of large turbine gear hobbing machines which are built in a range of sizes up to 200 in. gear diameter. Almost all these machines are for export.

The Foundry Division at Penistone, near Sheffield, is experiencing a steady request for high quality steel and bronze castings. A large number of top and bottom half castings for the outer casings for high pressure turbines is at present being produced. Fig. 2 shows one of these castings, of approximately 10 tons weight, being machined at the Penistone works prior to delivery to the customer. Other products of the Division include the David Brown-Bingham centrifugal pumps which are made under licence from the U.S.A. and are stated to be in good demand.

The Electron Beam

(*Continued from page* 459)

vaporization, and profile cutting can similarly be carried out, the beam being deflected electromagnetically to follow the required outline. Only very delicate "machining" operations on material not exceeding 1 mm. in thickness have been carried out hitherto, but the potentialities in this field are remarkable. Mr. Steigerwald has stated, for example, that in high grade steel 0·02 in. thick, a 0·0016-in. wide slit can be cut to an accuracy of approximately 5 per cent. As an indication of the kind of operations that may now be performed, moreover, he has shown an illustration of a spinning nozzle aperture formed by three slits at 120 deg., intersecting at their mid-points. Each slit appears to be about 0·002 in. wide by 0·038 in. long, and it is suggested that fibres of synthetic materials such as nylon, when drawn through such apertures, may enable textiles with improved properties to be produced.

It will be evident that electron beam machines represent an important addition to the available metal working equipment for a variety of specialized purposes, and in the field of welding operations are by no means confined to small workpieces. Indeed, Mr. Steigerwald has made reference to a machine with a vacuum chamber 20 metres long, in which parts with lengths up to 8 metres can be welded.

Forming and Testing Sheet Metal

An international Colloquium on Forming and Testing Sheet Metal will be held in Düsseldorf on May 23 and 24 under the joint sponsorship of the International Deep Drawing Research Group and the Verein Deutscher Eisenhüttenleute. The open sessions will be concerned with speed effects in sheet metal forming, and the influence of surface conditions in deep drawing. Those wishing to contribute papers, or desiring further information, should communicate with Mr. John Hooper, Secretary, I.D.D.R.G., John Adam House, John Adam Street, Adelphi, London, W.C.2.

NEWS OF THE INDUSTRY

The Midlands

J.L.S. ENGINEERING CO., LTD., Brook Street, Redditch, Worcs., designers and builders of industrial ovens in which re-circulated, indirectly heated air is employed for raising the temperature of the work, are as busy as ever with orders for customers in the U.K. and various countries overseas. J.L.S. ovens may be heated by gas, electricity, or oil fuel, to temperatures up to 850 deg. C., and by steam to 150 deg. C., for a wide variety of applications, including the tempering and stress relieving of steels; age hardening of aluminium alloys; annealing and pre-heating of glass products; core drying; stove enamelling; and coil baking.

Among the larger ovens now approaching completion in the works is one with 10 ft. by 12 ft. base measurements, and arranged for vertical operation in order to accommodate a 30-ft. long conveyor for transporting leaf springs through a tempering zone. Another oven, which will be employed for the solution treatment and ageing of light alloy pistons, has an overall length of 64 ft. and is arranged in two tiers connected by a conveyor. In contrast to the general run of work, a compact unit which is under construction has been specially designed for abstracting heat from components by forced air cooling. Goffing ovens, employed for tempering and flattening circular saws up to 7 ft. diameter and other saws up to 8 ft. long, are frequently supplied. These ovens are fitted with hand- or power-operated hydraulic presses, to prevent distortion of the work during the heat treatment cycle.

THE LEWIS SPRING CO., LTD., Resilient Works, Redditch, Worcs., are still busy in all departments with the production of extensive ranges of coil and flat springs for a variety of applications. An increasing demand is reported for spring parts plated with gold or silver and we may note that facilities are also available in the works for the electrodeposition of other metals. Special clips for anchoring transistors are being produced on an increasing scale to meet the needs of the electronics industry. Medium compression and extension coil springs can now be supplied in assorted sizes, packed in display boxes.

AERO HEAT TREATMENTS, LTD., Hudson's Drive, Cotteridge, Birmingham, inform us that their works are still fully occupied with the production of machined parts, a large proportion of which is for makers of earth moving equipment. Modern heat treatment facilities are available, and the machine shop is equipped for the production of repetition and ground parts. Additional toolroom capacity is shortly to be provided.

COLEY BROS. (TOOLS), LTD., Factory Centre, Kings Norton, Birmingham, 30, report a sustained call for their range of Exacta die sets which are available in standard and special sizes and may be provided with preloaded ball bushes as an alternative to plain bushes. Orders for die-set pry bars, packing blocks, work clamps, guide pins, punch shanks and other toolmakers' specialities are maintained at a satisfactory level. Activity in the flame-cutting department is well maintained as a result of increasing demands for profiled plates, many of which are afterwards ground or otherwise machined to customers' requirements. The heat treatment department is occupied in meeting the company's own requirements, and with work for other firms.

ROTOLIN BEARINGS, LTD., Factory Centre, Kings Norton, Birmingham, 30, a subsidiary of Coley Bros. (Tools), Ltd., are busy with the production of "S" type Rotolin linear motion bearings which are widely employed in die set assemblies. The development of these Rotolin ball bushes is being continued and new techniques have been introduced to facilitate production on a larger scale.

F.B.H. DURACHROME, LTD., Factory Centre, Kings Norton, Birmingham, 30, are experiencing a steady demand for their hard chromium electrodeposition service which affords a means of prolonging the life of components subjected to abrasion, heavy loading, or corrosive attack. A steady flow of work is received from makers of public service vehicles, including king pins and shackle pins. Reclamation work is also in progress and in this connection it may be noted that many shafts and other turned parts, rejected on account of machining errors, have been salvaged by plating oversize, followed by grinding to correct dimensions. Chromium plated hydraulic

rams for industrial and vehicle applications are regularly supplied, and we understand that the facilities for this class of work are steadily being increased. During recent years the plating equipment has been augmented to provide capacity for larger work, and parts up to 9 ft. long with weights up to 10 cwt. can now be plated.

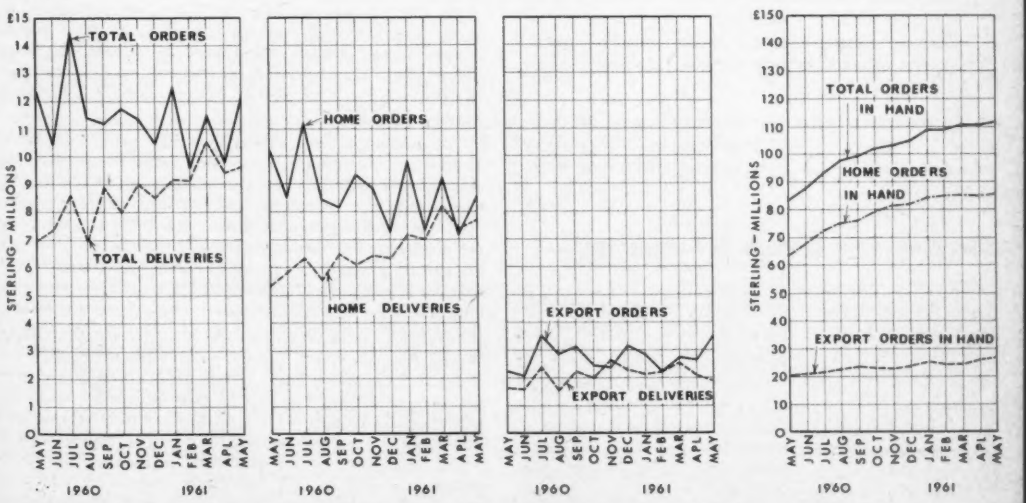
COMMERCIAL X-RAYS, LTD., Foundry Lane, Smethwick, Birmingham, 40, report that the demand for their services in the field of radiography is increasing. In the premises, which are classified as an approved test house by a number of recognized authorities, are installed X-ray equipment, rated at 250 kV., and apparatus for flaw and crack detection by magnetic and ultrasonic methods. Castings and welded structures produced from steel and light alloys can be X-rayed in one of the special lead-lined enclosures provided at the Smethwick works, or on site if necessary. The radiographs obtained are studied and any faults noted, such as inclusions, porosity and cracks, are fully interpreted. A fully automatic photographic dark room has been provided, for processing X-ray films in less than 8 min.

An associated company, Gamma-Rays, Ltd., produce a wide variety of portable apparatus in which emissive materials including cobalt 60, iridium 192, and caesium 137 are employed for obtaining radiographs of steel castings and structures up to 9 in. thick. One unit, known as type ASS/52, is provided with a magnetic clamping attachment which enables the radioactive material in its container to be accurately positioned on vertical faces of large tanks, ships' hulls, and similar structures for examination of welded seams.

ALDRIDGE TOOL & ENGINEERING CO., - LTD., Aldridge, near Walsall, Staffs., report that they have a very full order book for a wide range of special cutting tools. In spite of heavy commitments, delivery schedules are being maintained, and capacity is being found to meet particularly urgent requirements. Large numbers of the company's Alcodrive cutters are now in use, particularly for machining turbine blades. The Aldridge layout fixture has been completely redesigned, and now incorporates precision bearings which prevent any tendency to "stick" under various temperature conditions. Production of fixtures of the new design is well advanced, and the first should be available in the autumn.

A new steel stores and saw shop has recently been built, and it is planned to extend the machine shop, to provide an additional area of 7,500 sq. ft. Building of this extension will start in the spring of next year. Recently-installed plant includes a Newall NL thread grinder, a Matrix 2-way tap grinder, Jones-Shipman surface and tool and cutter grinders, Parkson universal milling machines, and Colchester lathes. A Hilger 600 projector is among the additional items of inspection equipment that have been provided.

F. W. HERRIDGE.



The above graphs show the values of machine tool orders and deliveries for the period ending May, 1961, also the values of orders in hand

Italian Machine Tool Production

According to the Italian trade magazine *Italy Presents*, the country is producing, at present, machine tools to the value of 75 million dollars per year, of which about 50 per cent. is being exported. Italy, it is stated, now occupies fourth place among European machine tool exporting countries, being surpassed only by West Germany, the United Kingdom, and Switzerland.

It is claimed that the productivity of Italian machine tool builders is now equal to that of corresponding American, British, German, and Swiss firms, and the graph in Fig. 1 shows how the output in Kg. per man/year has risen between 1950 and 1960. Variations in imports and exports of machine tools between 1956 and 1960, are shown in Fig. 2.

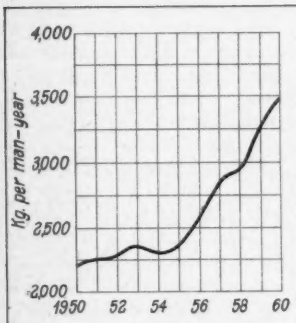


FIG. 1.

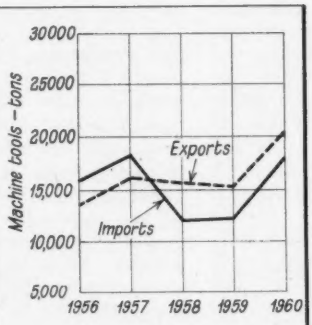


FIG. 2.

Fig. 1. Graph showing the rise in productivity in the Italian machine tool industry between 1950 and 1960

Fig. 2. Graph showing Italian imports and exports of machine tools between 1956 and 1960

Machine Tool Design Scholarships

The first group of students to whom Machine Tool Trades Association Design Scholarships were awarded in 1959 have now completed their academic studies on the special full-time course in machine tool design at Manchester College of Science and Technology. All nine students who were successful during the first year and embarked on their second year last October have satisfied the examiners and will be eligible for the award of the College diploma and the associateship (A.M.C.S.T.). The Machine Tool Trades Association acknowledges its appreciation to the College, and to Prof. Koenigsberger and his colleagues for the success of their endeavour. At present, these students are gaining industrial experience with machine tool builders in Western Europe and thus have the opportunity to "experience the benefit which will flow from the breadth of treatment of the Manchester course."

Names of the students and their employers, by whose co-operation they have been able to attend the course, are as follows: Mr. J. R. Earnshaw (Snow & Co., Ltd.), Mr. H. C. Fletcher (James Archdale & Co., Ltd.), Mr. R. G. Francis (Alfred Herbert, Ltd.), Mr. R. H. H. Hartley (James Archdale & Co., Ltd.), Mr. B. Hodgson (Wm. Asquith, Ltd.), Mr. D. Horobin (B.S.A. Tools, Ltd.), Mr. D. S. T. Nunney (James Archdale & Co., Ltd.), Mr. A. Shaw (Wm. Asquith, Ltd.), and Mr. T. D. Yarwood (H. W. Kearns & Co., Ltd.). The College has awarded a prize to Mr. B. Hodgson.

It is also announced that all students to whom scholarships were awarded in 1960 were successful during their first year and will proceed to the second year. Of these students, Mr. J. W. Anderson (Giddings & Lewis-Fraser, Ltd.) was awarded a College prize for his progress in the first year.

Industrial Notes

An Auction Sale of Machine Tools and miscellaneous stores from the W.D. Storage Depot, South West Stores, Euxton Lane, Chorley, Lancs., will be held at Cheetham Town Hall, Manchester, 8, on September 5. The auctioneers will be J. H. Norris & Son (Dept. L), 9 Albert Square, Manchester, 2.

Hardinge Machine Tools, Ltd., Hampton Road West, Hanworth, Feltham, Middlesex, inform us that on September 6 their mobile demonstration unit will be leaving their works for Switzerland, for a tour of three weeks' duration. Although such units have been employed by the company since 1952, this will be the first trip that has been made abroad. The unit will carry a Hardinge HLV lathe with copying equipment, an HCT precision chucking lathe and a DSM.59R high-speed second-operation lathe.

Precision Gear Machines & Tools, Ltd., Red Ring Works, Bodmin Road, Coventry, have recently added the types G.S.C. 10-in. and G.S.J. 18-in. Red Ring gear speeders, to the wide range of gear processing machines and auxiliary equipment which they are now making and marketing. This gear speeder may be equipped with a microphone, broad-band amplifier, and meter, to enable sound intensity to be measured, and indicated by a pointer on a graduated scale. With such equipment an operator is not required to rely upon his judgement in assessing the degree of noise.

Metachemical Machines, Ltd.

A new company with the title Metachemical Machines, Ltd., has been formed on an equal basis by B.S.A. Tools, Ltd., Mackadown Lane, Kitts Green, Birmingham, 33, and Metachemical Processes, Ltd., Crawley, Sussex, for the development and production of equipment for electrochemical machining. Metachemical Processes are the British associates of the Steel Improvement & Forge Co., Cleveland, Ohio, U.S.A., and under new agreements technical information will be made available by that company to Metachemical Machines, Ltd. Development work will be carried out at Crawley, but production of equipment will be undertaken initially by Kemworthy Jig & Press Tool Co., Ltd., Merton, S.W.19, which has been acquired by Metachemical Machines as a wholly-owned subsidiary.

Products of the new company will be sold in the home market by Burton, Griffiths & Co., Ltd., Kitts Green, Birmingham, and overseas by the export organization of B.S.A. Tools, Ltd.

Scrap Metals

†LONDON.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—Clean copper wire, untinned and free from lead and solder, £200; clean heavy copper, untinned and free from lead and solder, £194; copper wire No. 2, £190; clean light copper, £186; braziery copper, £160; gunmetal, £172; brass, mixed, £126; lead, net, £51; zinc, £35; cast aluminium, £95; old rolled aluminium, £96; battery lead, £26; unsweated brass radiators, £100; hollow pewter, £570; black pewter, £450.

MIDLANDS.—Since the holiday period, copper prices have shown little change. Most grades can be sold fairly easily, and merchants having bought large quantities prior to the holidays are anxious to deliver material quickly.

The market for tin is strong, and prices have increased by about £30 per ton over the past two weeks.

The position as regards the principal metals is as follows:—

Copper.—Braziery scrap is out of favour and prices have fallen by at least £5 per ton. Vat wire has also followed this downward trend. Demand for the better grades of bright No. 1 wire and heavy scrap remains reasonably strong. There is a tendency for buyers to show a little more caution when quoting for smaller quantities.

Brass.—A steady demand continues for mixed heavy material, and prices are firm.

Gunmetal.—There are ready outlets at somewhat higher prices.

Lead.—The market has shown no improvement, and lack of interest has brought prices down by a further £1 per ton. Merchants wait for an occasional rise, related to demand, before disposing of accumulated stocks.

Aluminium.—The outlook is not at all encouraging, and if anything values are tending to fall. Material can be moved but prices are not very attractive. So far there is no indication of a better tone in the future.

Zinc.—Prices, in general, have fallen by a further £2 per ton.

† George Cohen, Sons & Co., Ltd., 600 Wood Lane, London, W.12.
‡ Subject to market fluctuations.

MACHINERY'S ENQUIRY BUREAU

For many years MACHINERY has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (MACHINERY, Enquiry Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

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Machine Tool Share Market

Activity in stock markets remained at a very low level during the period under review, with prices tending to fall in most sections, but encountering resistance.

The gilt-edged market sustained a moderate turnover, but after being mainly firm, it became reactionary, and British Funds, together with similar fixed interest stocks, finished with a slight setback in values.

Commercial and industrial share markets were subdued and dull, and for the most part displayed an easier tendency, but towards the close a brighter tone developed.

Among machine tool issues Arnott & Harrison advanced 9d. to 10s. 3d.; Alfred Herbert, 1s. to 67s. 6d.; B. & S. Massey, 6d. to 10s. 6d.; Samuel Osborn, 6d. to 48s. 6d.; and Ambrose Shardlow, 1s. 10½d. to 56s. 10½d. On the other hand, Abwood Machine Tools lost 3d. at 1s. 6d.; Asquith Machine Tool, 3d. at 9s. 3d.; Birmingham Small Arms, 6d. at 22s. 6d.; Chas. Churchill, 1½d. at 9s.; Clarkson Engineers, 1s. to 6s. 6d.; Geo Cohen, 3d. to 10s. 9d.; Coventry Gauge & Tool, 6d. at 28s. 4½d.; Craven Bros. (Manchester), 3d. at 8s. 6d.; Greenwood & Batley; 2s. 4½d. at 17s. 9d.; John Harper, 4½d. at 6s. 9d.; John Holroyd "B," 1s. at 17s. 6d.; H. W. Kearns, 9d. at 21s. 3d.; Newall Engineering, 3d. at 7s. 3d.; W. E. Norton (Holdings), 6d. at 8s.; F. Pratt, 1s. 6d. at 16s. 3d.; Sheffield Twist Drill, 3d. at 19s.; W. E. Sykes "B," 6d. at 28s. 3d.; and Tap & Die Corporation, 1s. at 15s. 6d.

ABWOOD MACHINE TOOLS, LTD.—Final dividend 7½ per cent, making, with the interim, a total distribution of 12½ per cent.

A. A. JONES & SHIPMAN, LTD.—Interim dividend 5 per cent.

B. ELLIOTT & Co., LTD.—Final dividend 10 per cent.

New Appointments

The following new appointments have been announced:—

MR. PETER BONNER, B.Sc., A.M.I.Mech.E., A.M.I.Prod.E., as a director of T. C. Jones & Co., Ltd., structural engineers, of London and Treorchy, South Wales, an associate company of The George Cohen 600 Group, Ltd.

MR. H. JOHNSON as technical representative for Lancashire and the North West Coast, and MR. H. B. TRAVIS, as technical representative for Yorkshire, and the North East Coast, for Suffolk Iron Foundry (1920), Ltd., Stowmarket, Suffolk.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	1/6
Allen (Edgar) & Co., Ltd.	Ord.	£1	35/3
" " "	5% Prf.	£1	13/-*
Arnott & Harrison, Ltd.	Ord.	4/-	10/3
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	9/3
" " "	6% Cum. Prf.	£1	16/6
Birmingham Small Arms Co., Ltd.	Ord.	10/-	22/6
" " "	5% Cum. "A" Prf.	£1	14/-
" " "	6% Cum. "B" Prf.	£1	16/-
" " "	4% 1st Mort. Deb.	Stk.	92½
British Oxygen Co., Ltd.	Ord.	5/-	18/6
" " "	6% Cum. Prf.	£1	18/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	8/10½
Broom & Wade, Ltd.	Ord.	5/-	24/9
" " "	6% Cum. Prf.	£1	16/6
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	15/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/-
Butler Machine Tool Co., Ltd.	Ord.	5/-	15/-
" " "	5% Cum. Prf.	£1	12/6
Churchill (Charles) & Co., Ltd.	Ord.	2/-	9/-
" " "	6% Cum. Prf.	£1	25/7½‡
Clarkson (Engrs.), Ltd.	Ord.	5/-	6/6
Cohen (George), 600 Group, Ltd.	Ord.	5/-	10/9
" " "	4½% Cum. Prf.	£1	11/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	28/4½
" " "	5% Cum. Red. Prf.	£1	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/-	8/6
Elliott (B.) & Co., Ltd.	Ord.	1/-	2/6
" "	4½% Red. Cum. Prf.	£1	12/-
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	10/-
Greenwood & Batley, Ltd.	Ord.	10/-	17/9
Harper (John) & Co., Ltd.	Ord.	5/-	6/9
" " "	4½% Red. Cum. Prf.	£1	11/7½
Herbert (Alfred), Ltd.	Ord.	£1	67/6
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	20/-
" "	"B" Ord.	5/-	17/6
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	24/6
" " "	7% Cum. Prf.	5/-	4/9
Kearney & Trecker-C.V.A., Ltd.	5½% Red. Cum. Prf.	£1	8/9
" " "	Prefd. Ord.	£1	13/9
Kearns (H. W.) & Co., Ltd.	Ord.	5/-	21/3
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	9/-
Macreadys Metal Co., Ltd.	Ord.	5/-	15/-
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/6
Massey (B. & S.), Ltd.	Ord.	5/-	10/6
Newall Engineering Co., Ltd.	Ord.	2/-	7/3
Newman Industries, Ltd.	Ord.	2/-	7/-
" "	6% Prf. Ord.	5/-	5/-
Noble & Lund, Ltd.	Ord.	2/-	5/9
Norton, W. E. (Holdings), Ltd.	Ord.	2/-	8/-
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	48/6
" " "	5½% Cum. Prf.	£1	22/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	16/3
Sanderson Kayser, Ltd.	Ord.	10/-	29/4½
" " "	6½% Cum. Prf.	£1	16/3
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	8/6
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	56/10½
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	15/4½xd
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	19/-
" " "	5% Cum. Prf.	£1	13/3
Stedall & Co., Ltd.	Ord.	5/-	7/6
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	28/3
Tap & Die Corporation, Ltd.	Ord.	5/-	15/6
" " "	4½% Deb. 1961-1977	Stk.	80½
Wadkin, Ltd.	Ord.	10/-	26/-
Ward (Thos. W.), Ltd.	Ord.	£1	72/6
" "	5% Cum. 1st Pref.	£1	13/6
" "	5% Cum. 2nd Pref.	£1	20/-
Willson Lathes, Ltd.	Ord.	1/-	3/-xd

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. ‡ Birmingham price.

Aug

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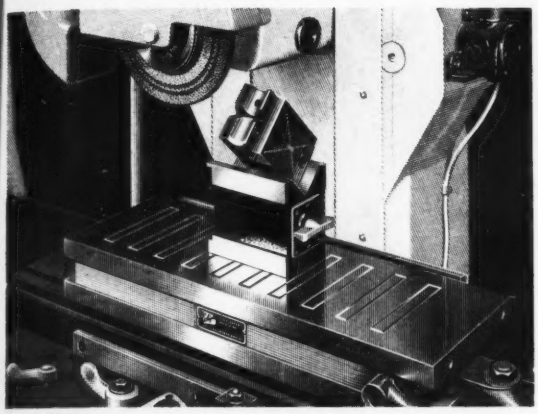

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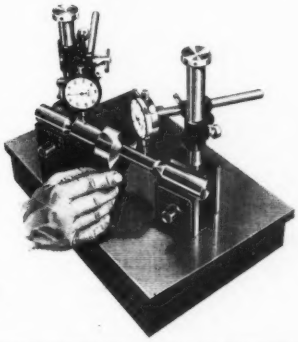

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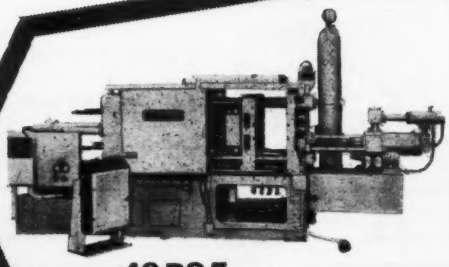
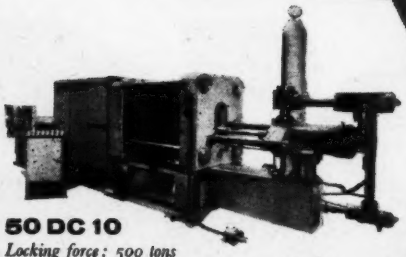
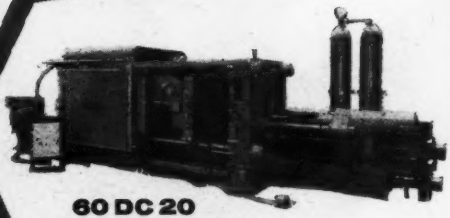


40 DC 5
Locking force: 300 tons
Shot weight: 5½ lb. aluminium 15 lb. brass



50 DC 10
Locking force: 500 tons
Shot weight: 11 lb. aluminium 30 lb. brass



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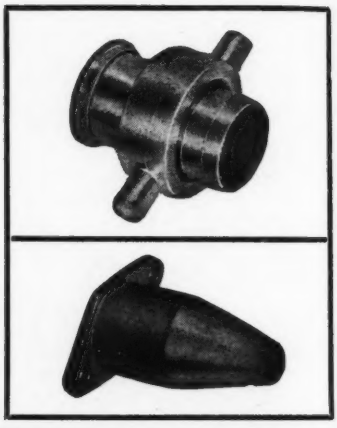

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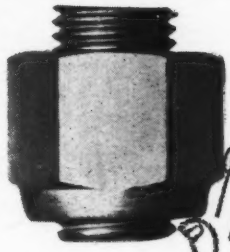

** These times are based on 'The Handbook of Standard Time Data for Machine Shops' by Haddon & Genger published by Thames and Hudson Limited, London.*

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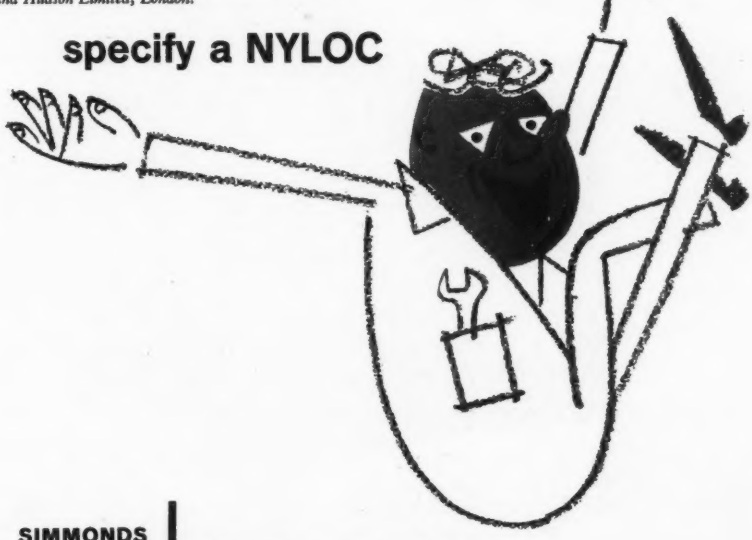

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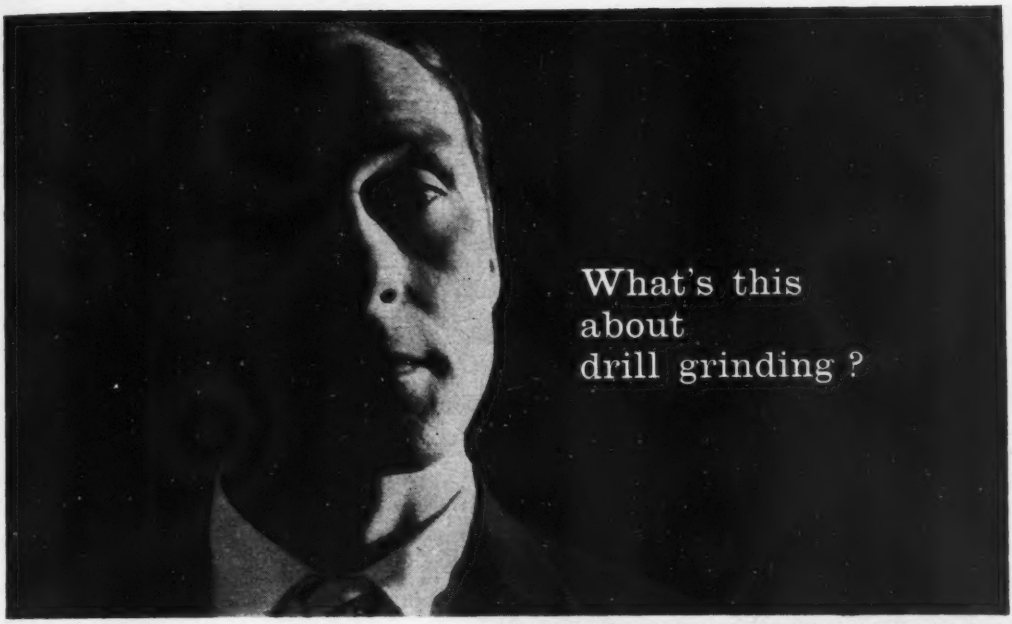

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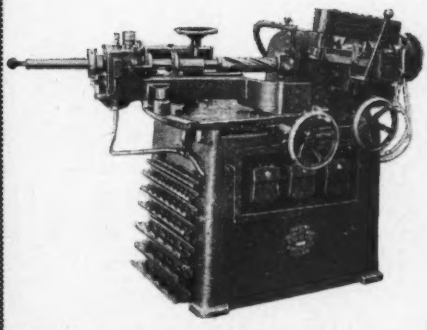

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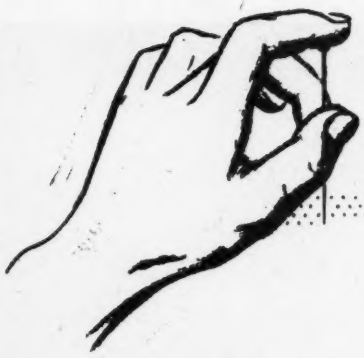

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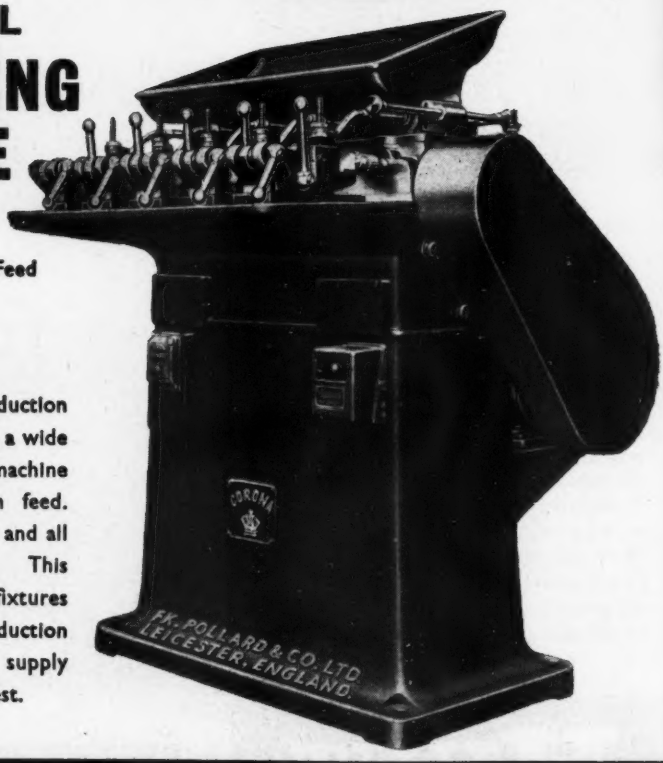

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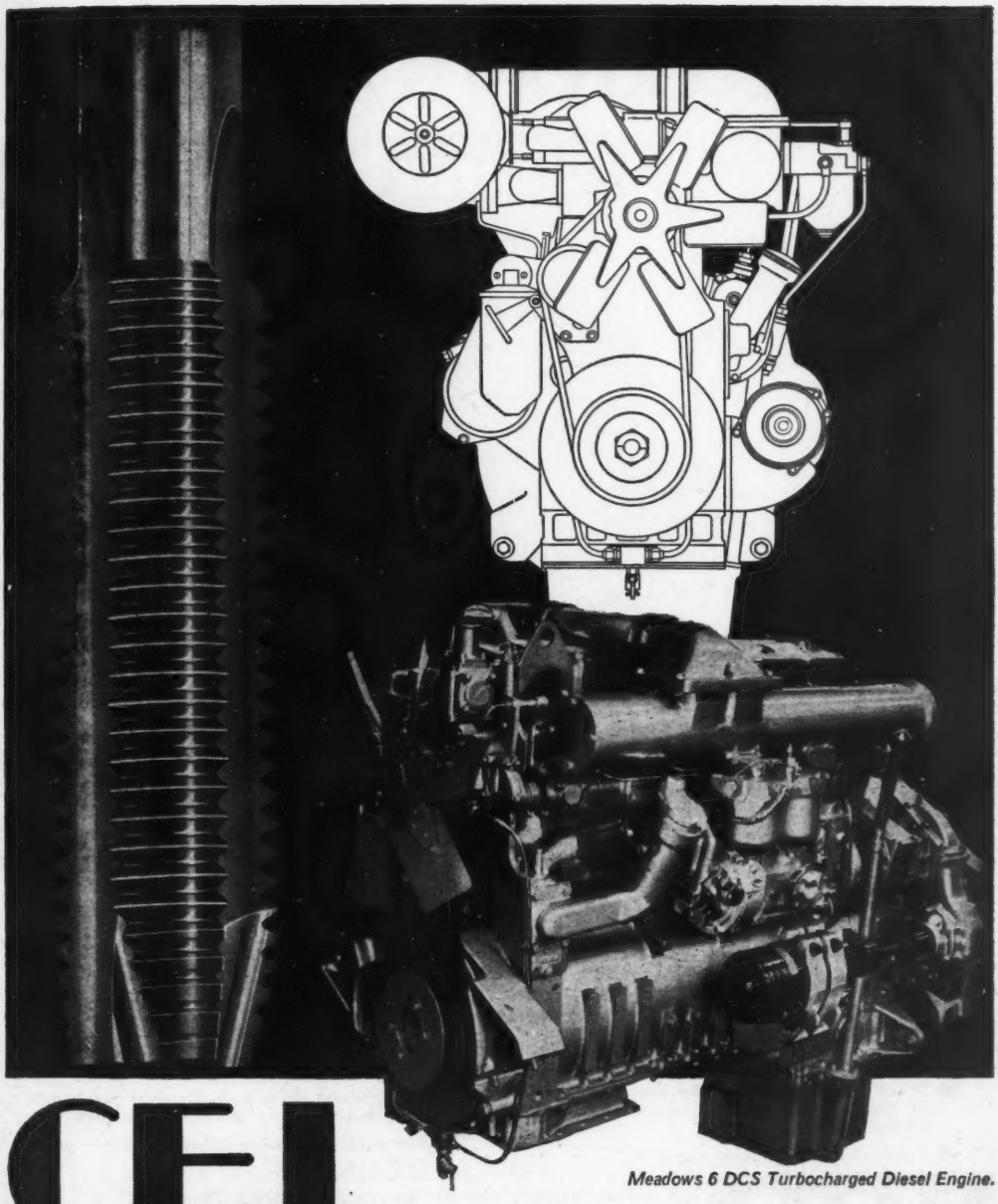

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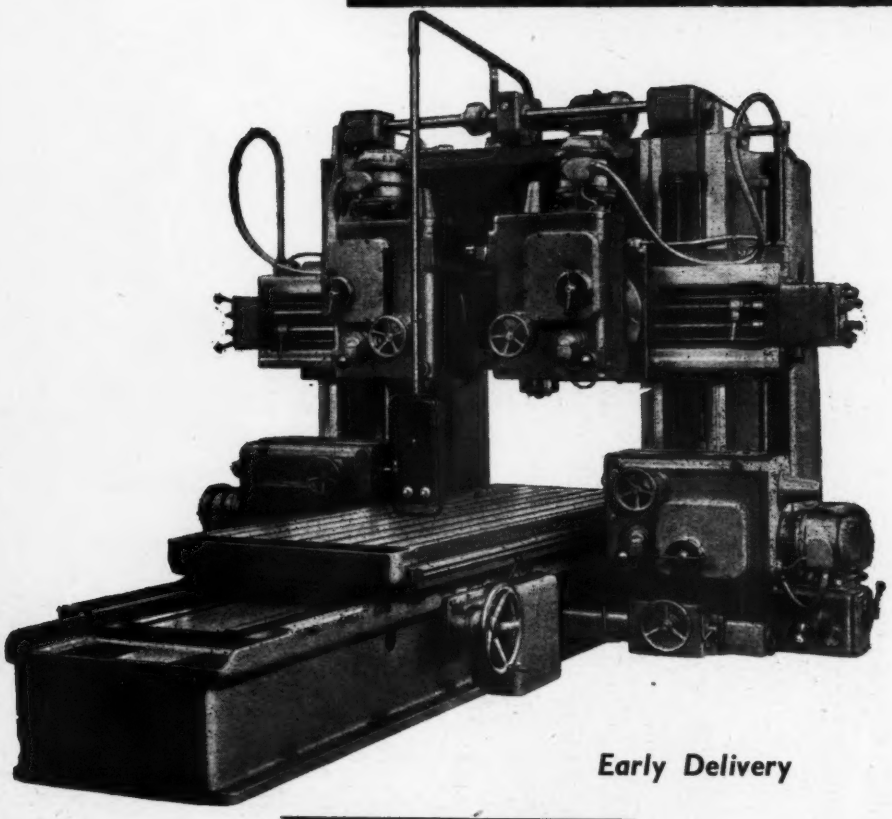

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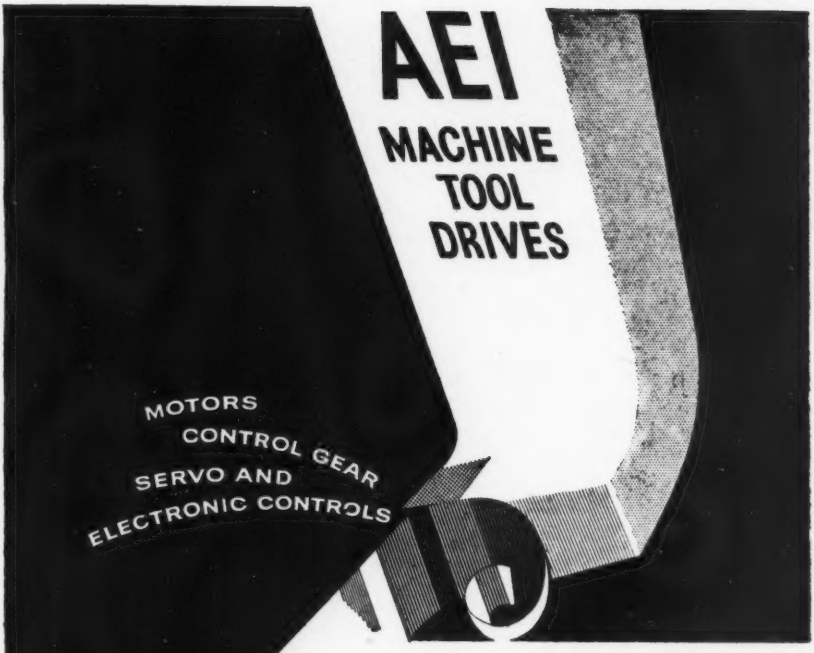

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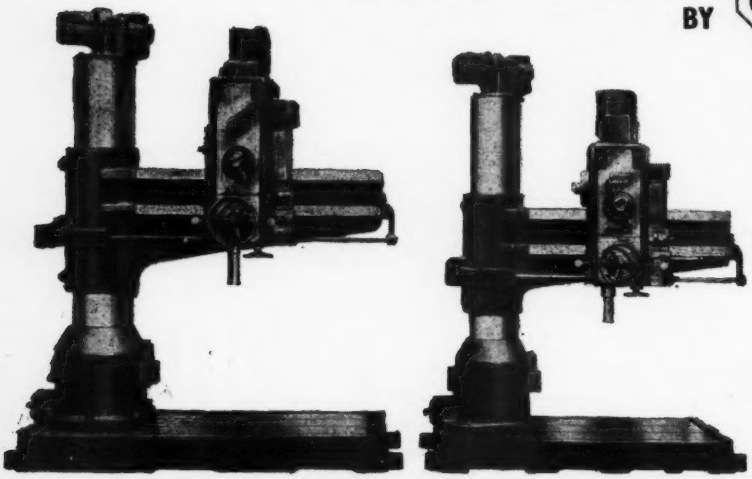

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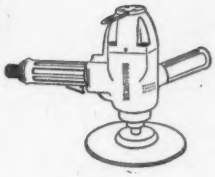

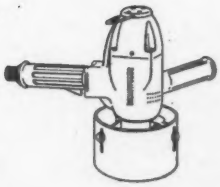

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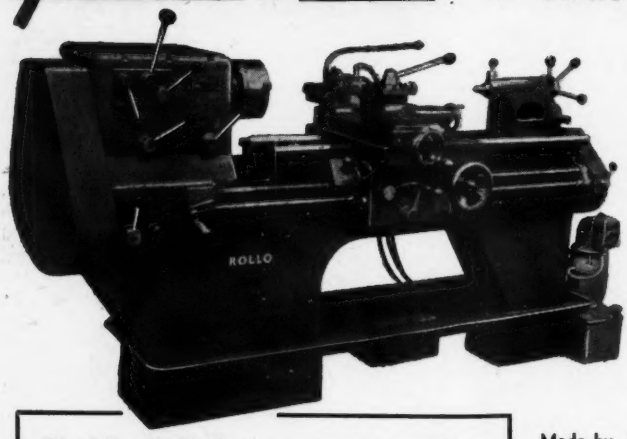

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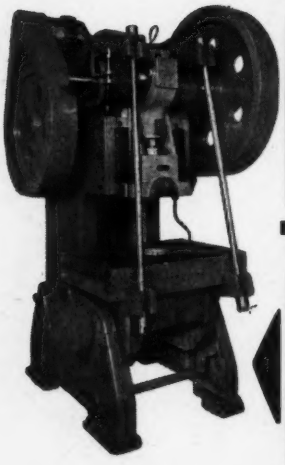

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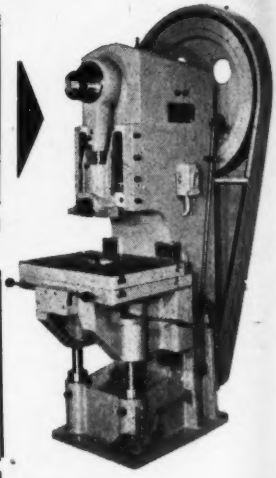

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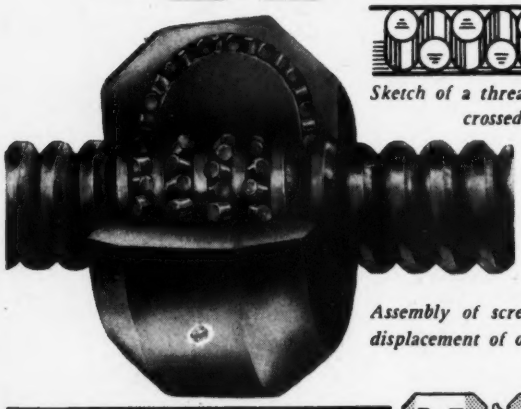

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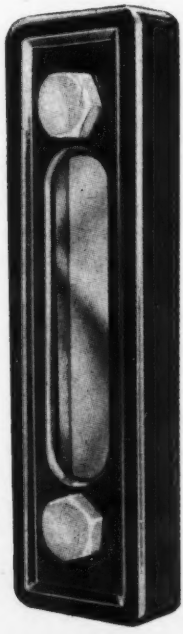

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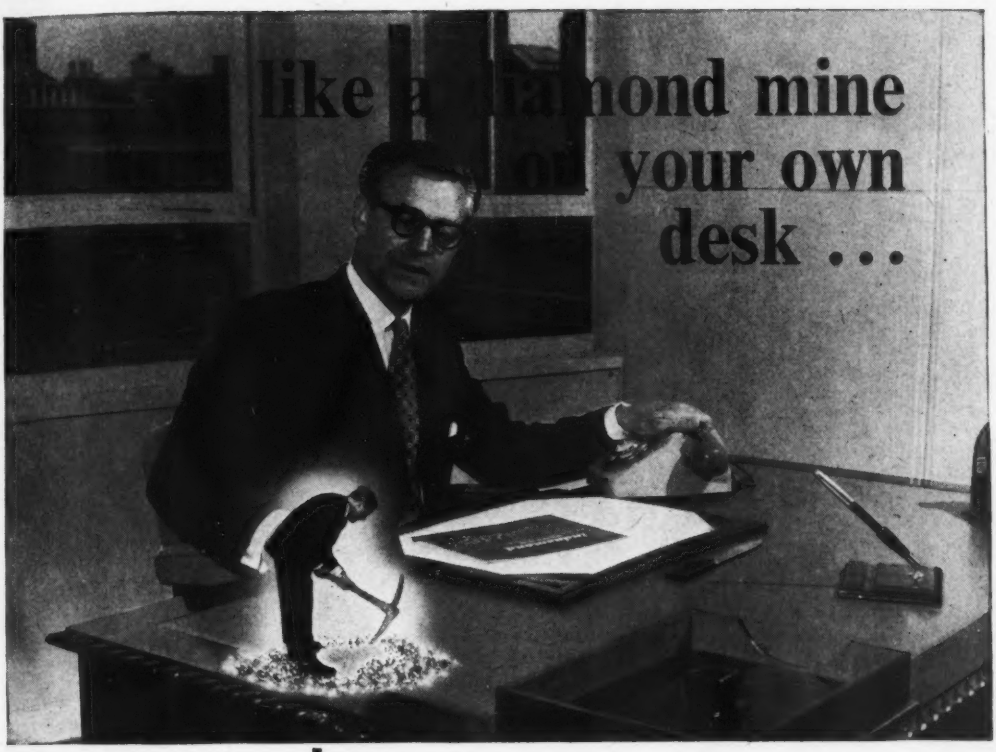

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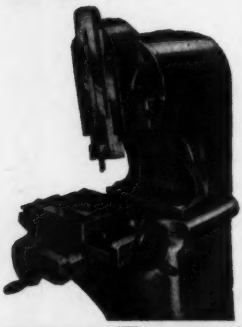

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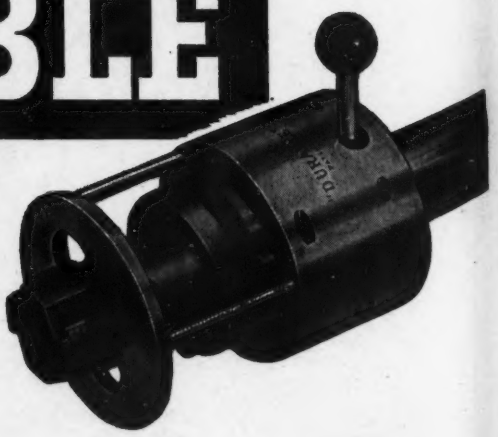

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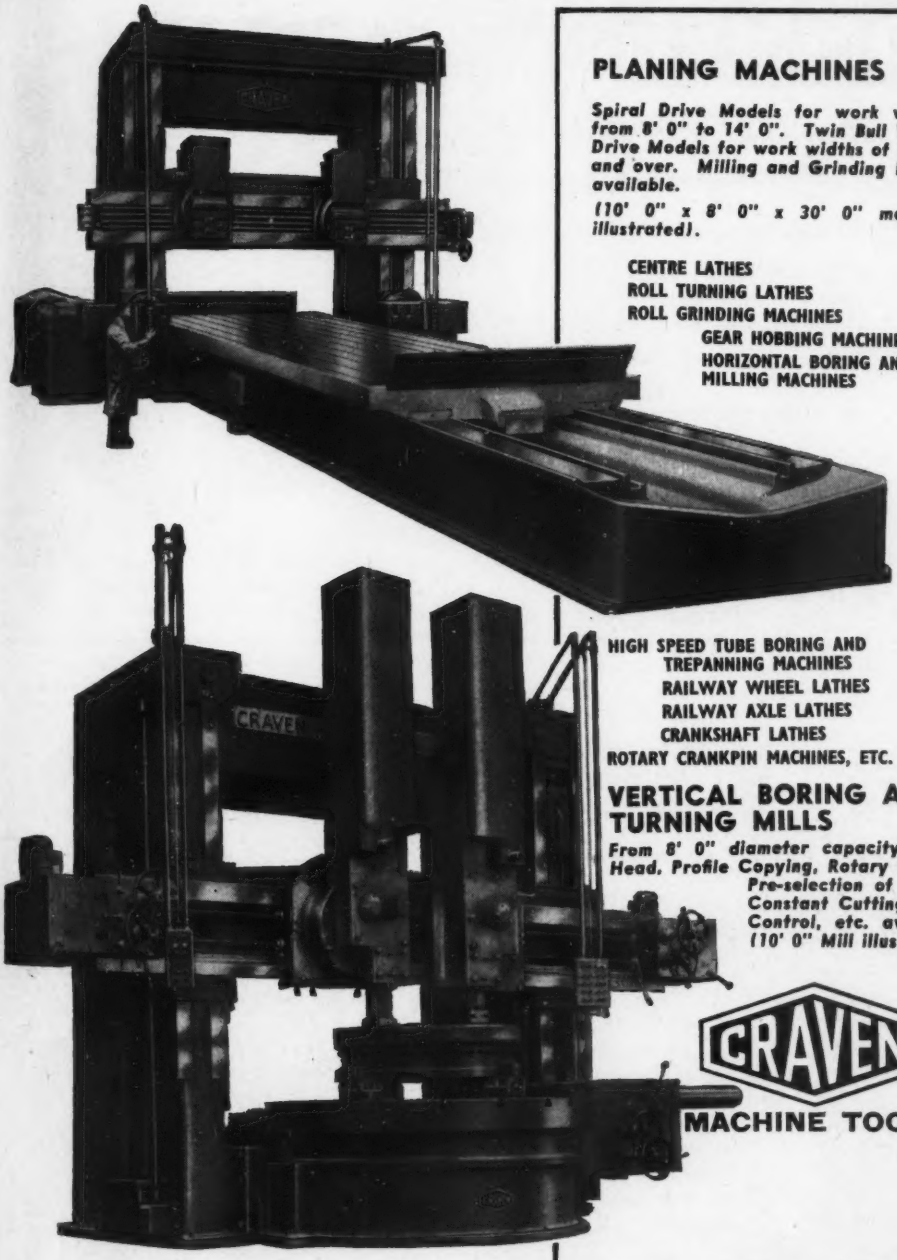

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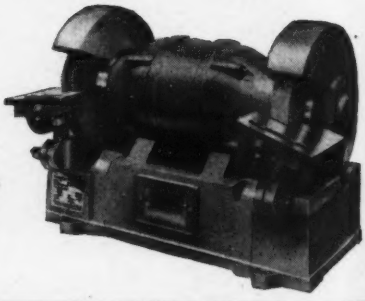

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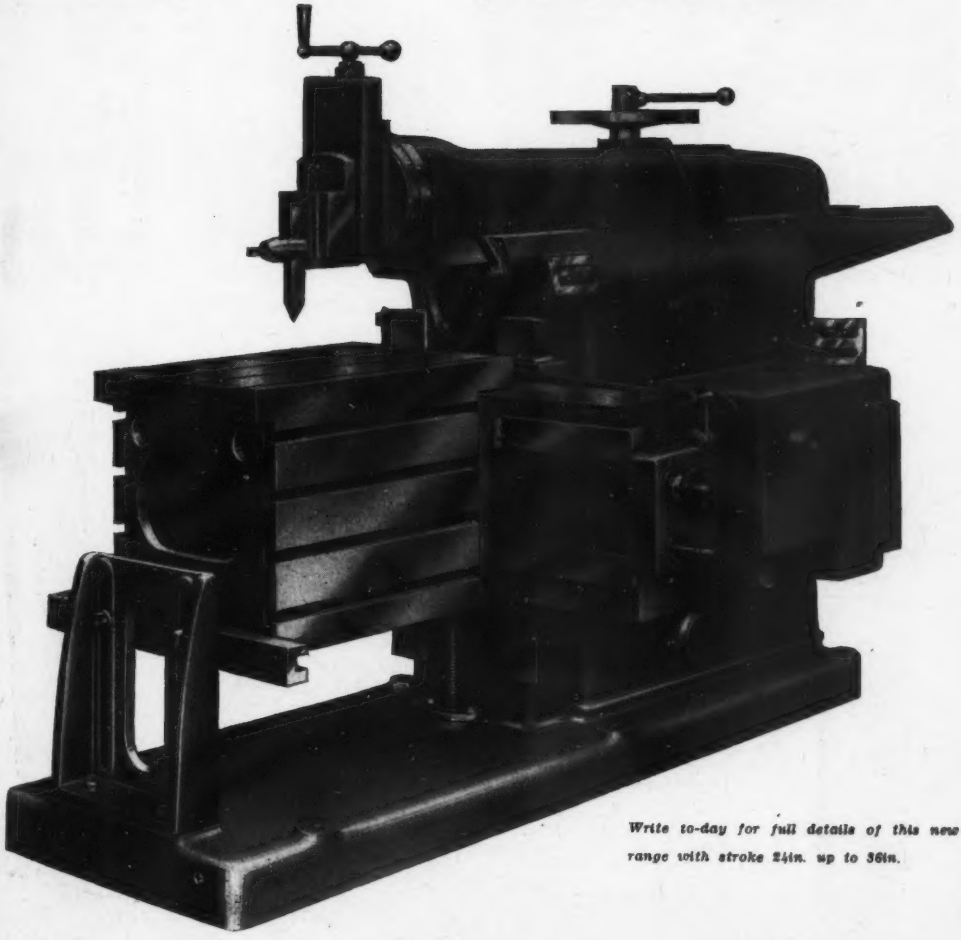
★ **PUSH BUTTON CONTROLLED**



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ORMEROD SHAPERS LTD. *Member of the Asquith Machine Tool Corporation*

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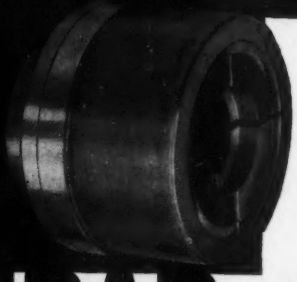
The Dunbar & Cook

Collet Chuck



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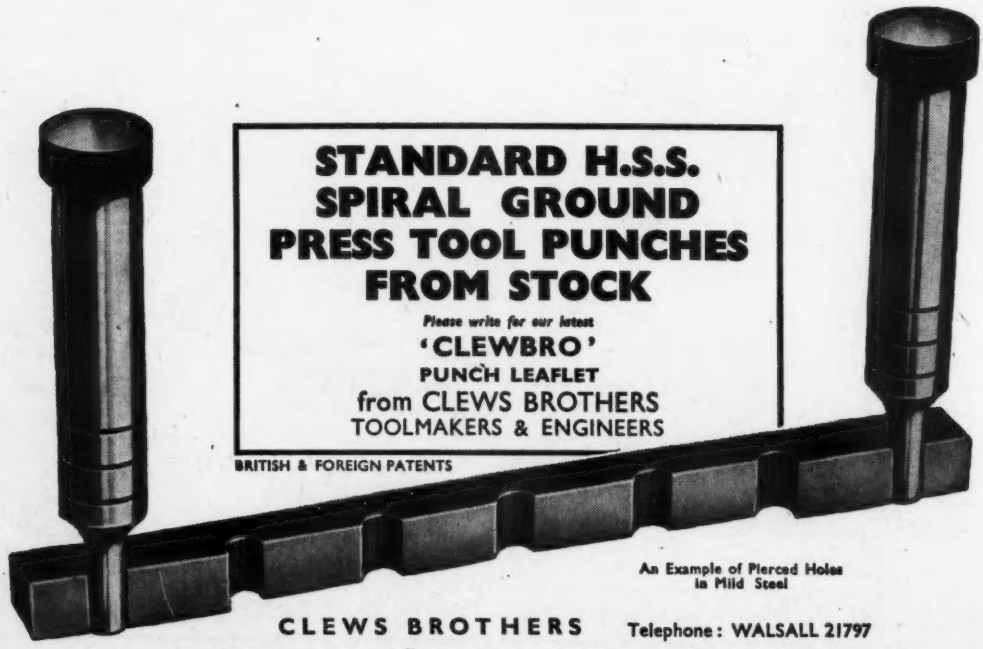

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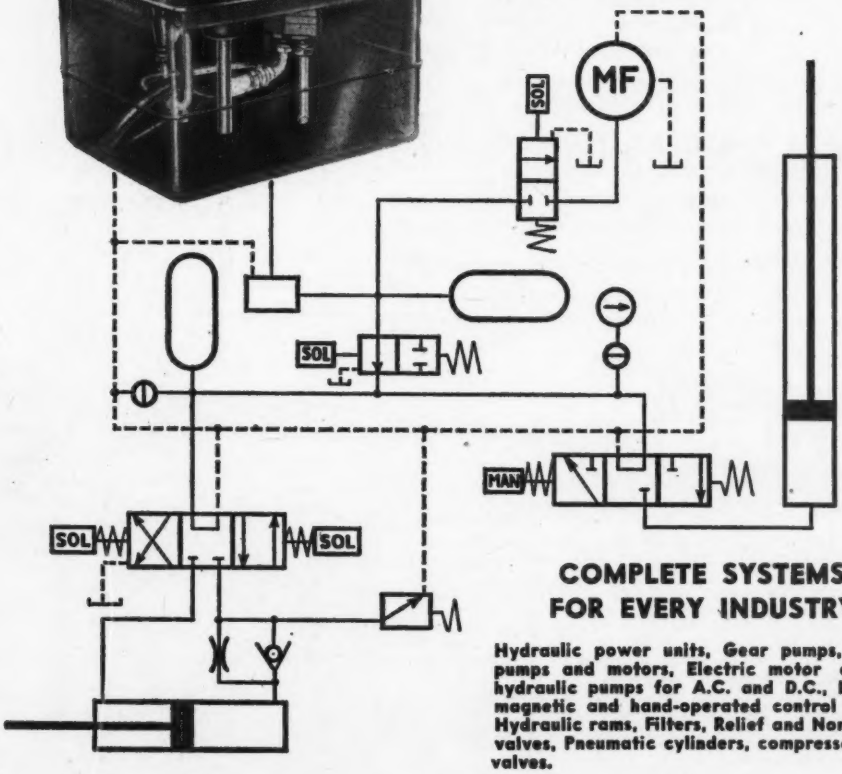

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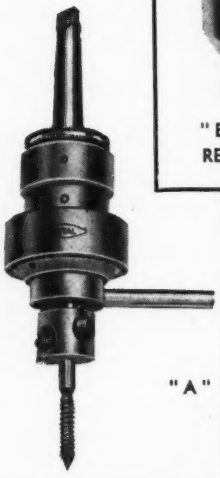

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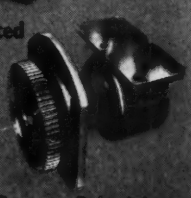

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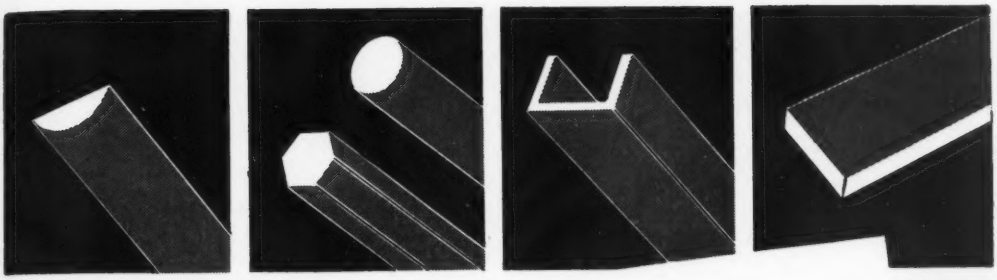

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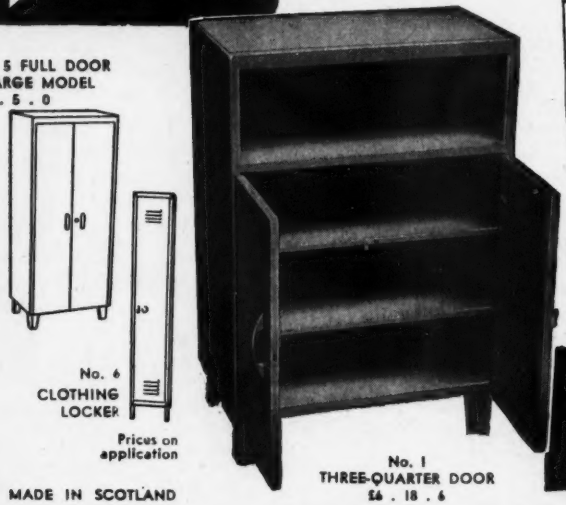

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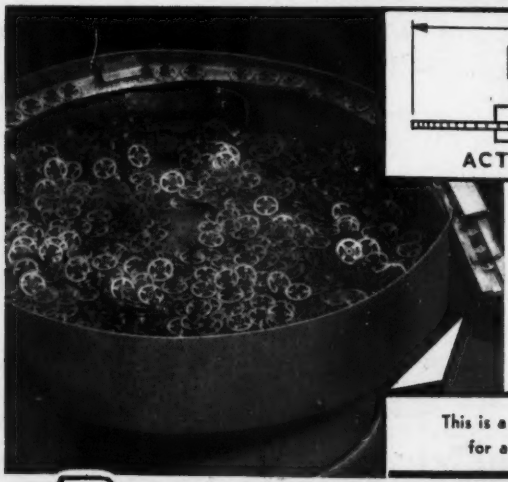

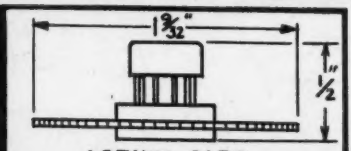

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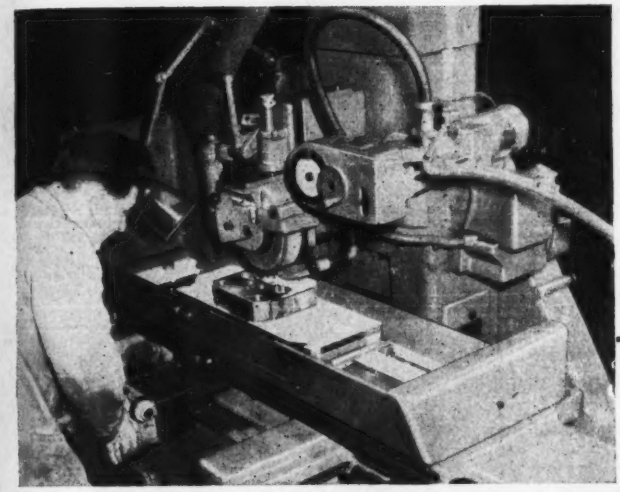

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J & S Model 1011—12" x 27" Surface Grinder fitted with Power Rise and Fall to the wheelhead. It is shown grinding a Cavity Plate for an Injection Moulding Tool.

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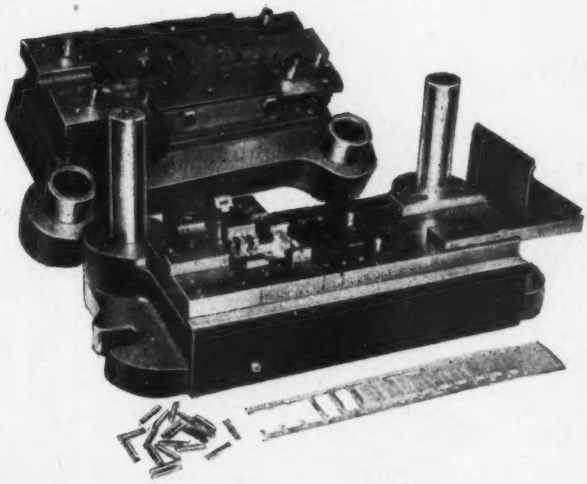
In the toolroom Jones-Shipman Cylindrical and Surface Grinders predominate and it is on these machines that a great responsibility is placed in assuring the precision grinding results of the many die-sets and moulds required for the manufacture of these high quality products.



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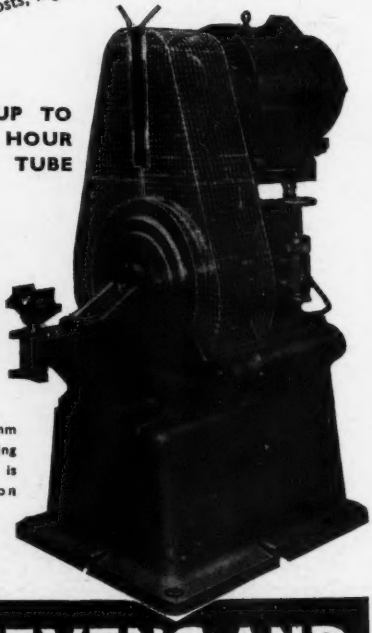
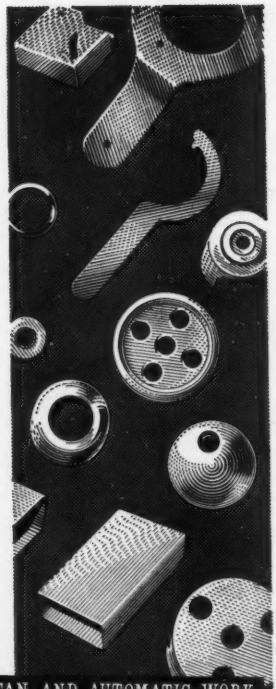


International Machine Tool Exhibition Brussels— Hall No. 9. Stand 9024. September 3-12

A short 16mm film describing this machine is available on application.

STEVENS AND BULLIVANT Ltd
WESTERN ROAD BIRMINGHAM 12 ENGLAND



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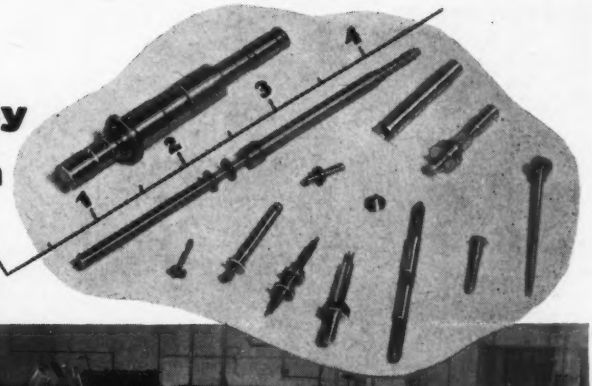

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Ideally suitable for the large scale production of high precision parts—both simple and complex—the TORNOS sliding head automatic with its many special features is unequalled for performance, precision and workmanship. Eight models are available with a stock capacity of 4 to 32 m.m., and details will gladly be sent on request.

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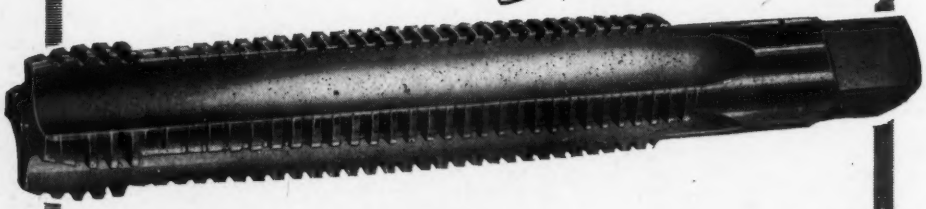

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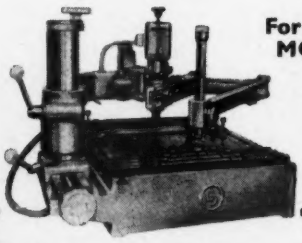

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MODEL 713 Gives reductions from 2:1 to 8:1. Easy operation enables engraving to be carried out nearly as fast as ordinary writing. Exceptionally sensitive balanced pantograph, giving automatic withdrawal of cutter and tracer.

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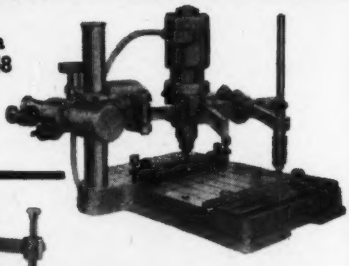

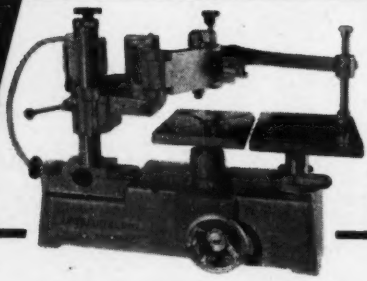

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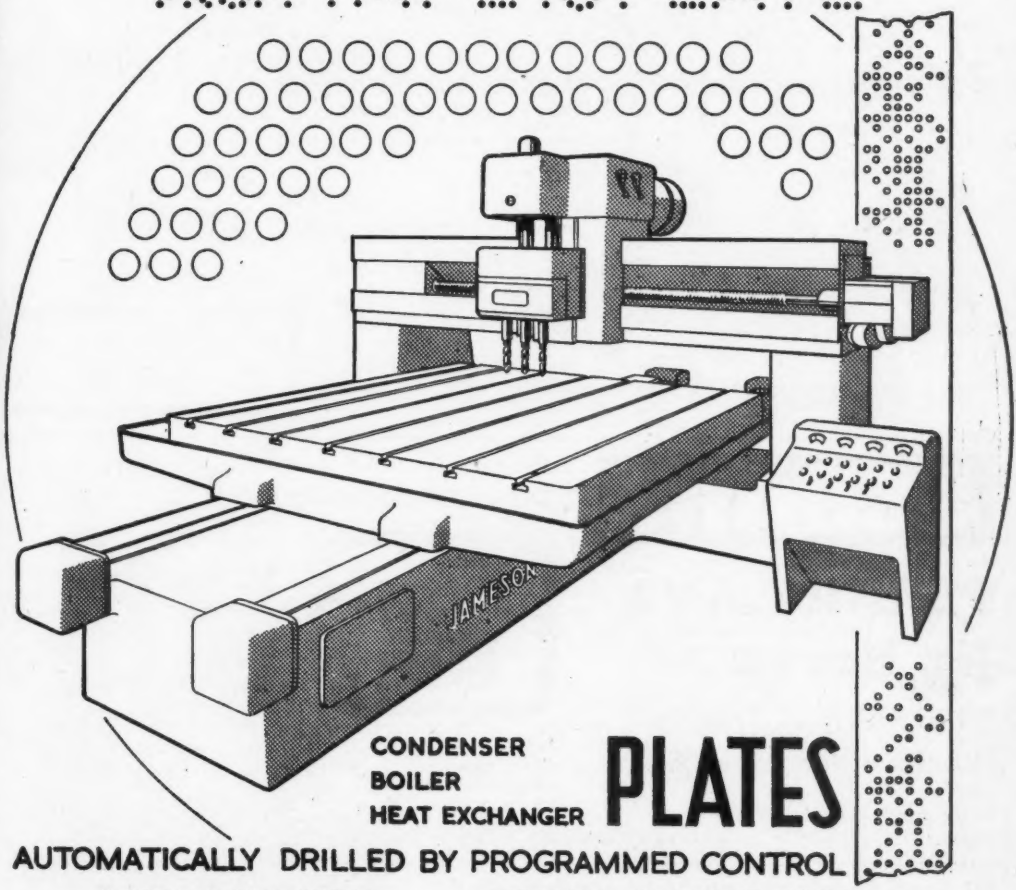

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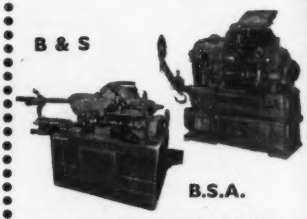

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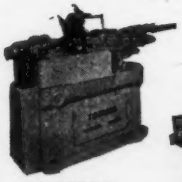
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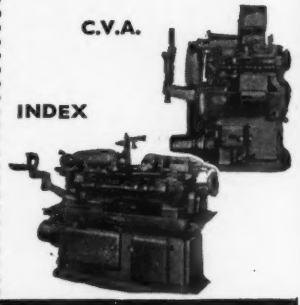
- Machines are rebuilt to original specification of accuracy and limits.
- All parts fitted are interchangeable with maker's spares.
- Reconditioning not only costs less than a new machine but can also be charged wholly as a maintenance expense ranking for full tax relief.
- We can loan a machine equivalent to the one taken out thereby assuring customer of his continuity of production.



★ May we visit your works and quote for reconditioning your machine?

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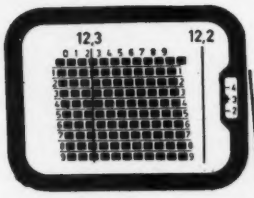
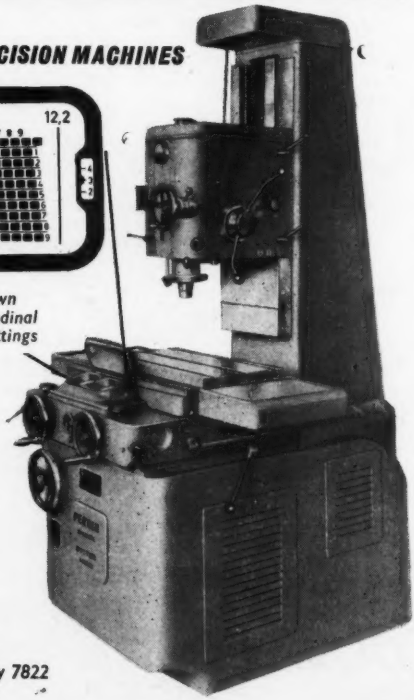
WITH OPTICAL TABLE

automatic positioning available



Two scales as shown controlling longitudinal and transverse settings



Boring capacity in cast iron 4in.
Table size 19¾in. × 11in. Longitudinal movement 16in.
Transverse movement 11in.
Max. distance spindle to table 18½in. Infinitely variable spindle speeds from 60-3200 r.p.m. with power feed to spindle.

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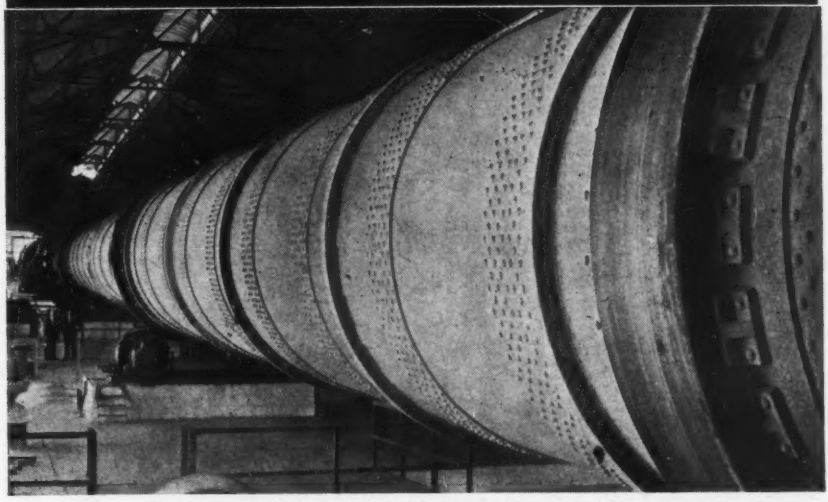

Badly scored main gear shaft journals of this large rotary cement kiln were restored by applying METCOLOY 2. Photo by courtesy of The Rugby Portland Cement Company Ltd.

Faced with a replacement cost of £2,000 when the journals of the kiln main gear shafts became badly scored, The Rugby Portland Cement Company Ltd. decided to build up the worn areas by metallizing. The shafts were prepared and then flame-sprayed to build up the journals by ¼" using METCOLOY 2—a hard, corrosion resistant alloy. After machining to original size, the kilns were soon back in full production. Direct metallizing costs on these large shafts were under £40. Last year—eight years later—routine inspection found no measurable wear of the metallized journals and considerable further life can be expected before respraying.

Similar problems are being solved with METCO Flame Spray Equipment by companies throughout the world. If you are concerned with wear or corrosion —or both—you must investigate flame spraying. A booklet giving Engineering Data on Sprayed Coatings is available to you. Please let us know where to mail it.

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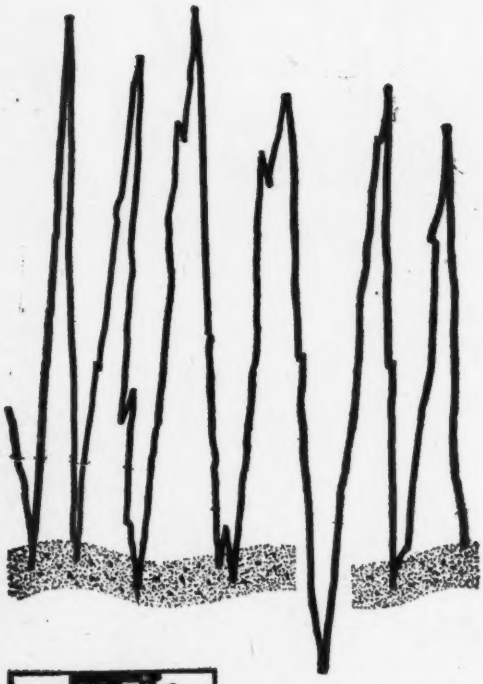

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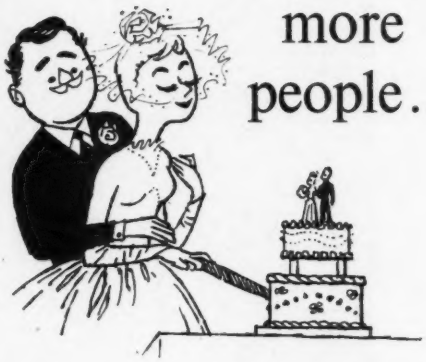

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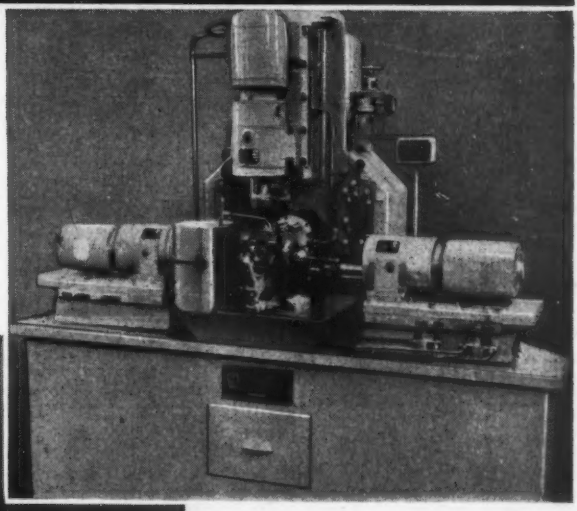

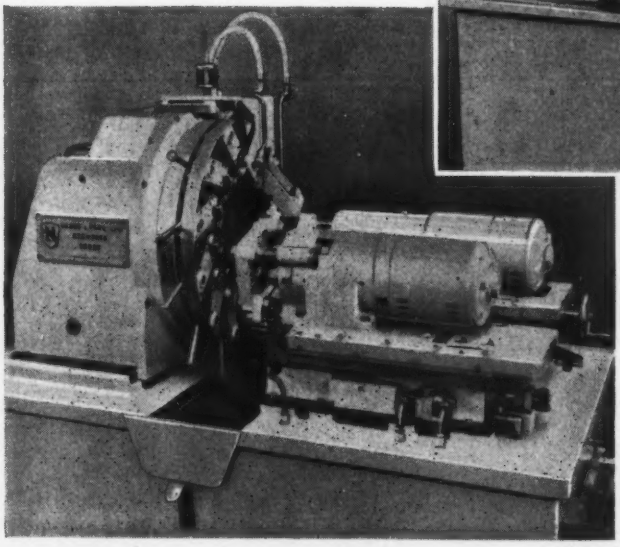

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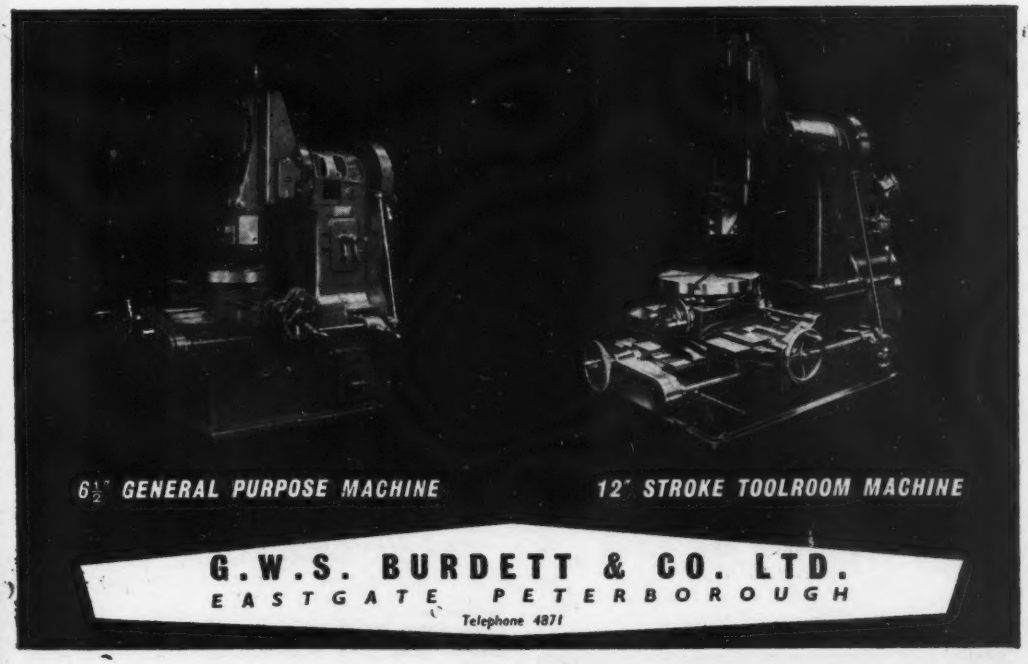

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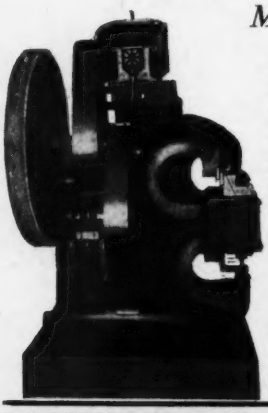

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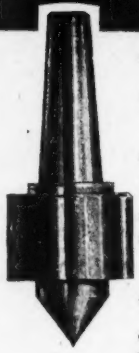

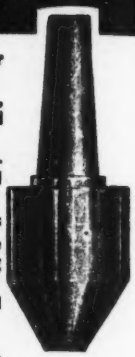

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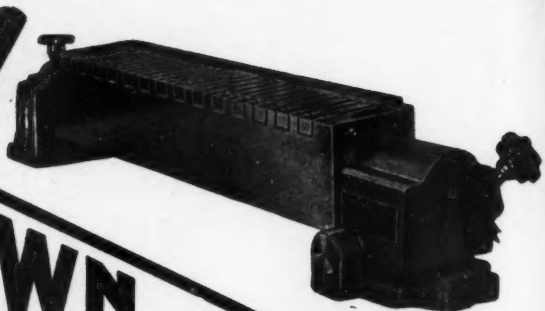

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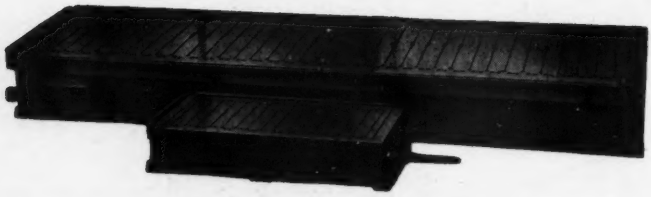

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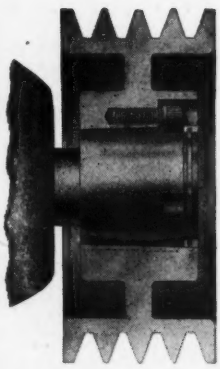

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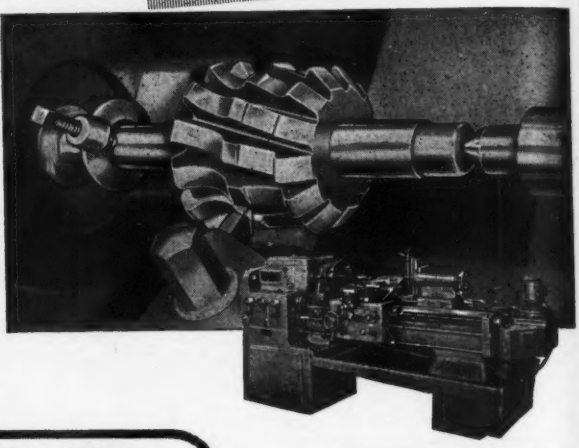

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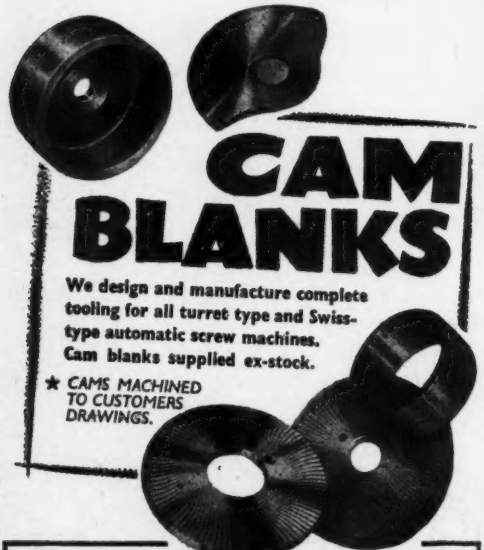

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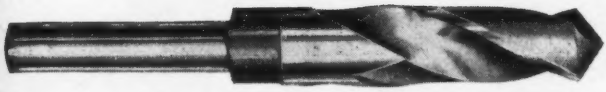

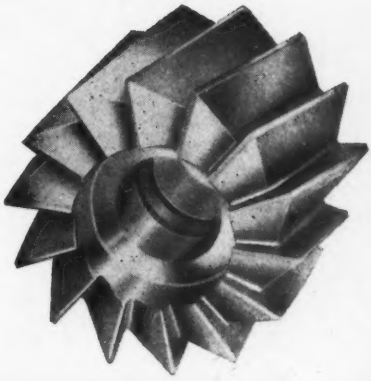

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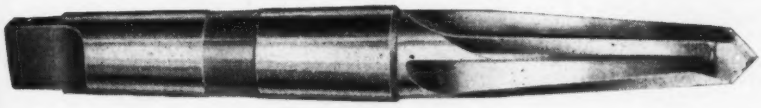

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4	28in. by 8in.	19in.
5	28in. by 10in.	19in.

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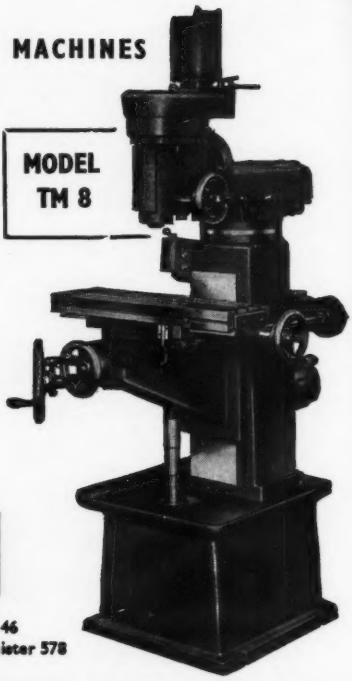

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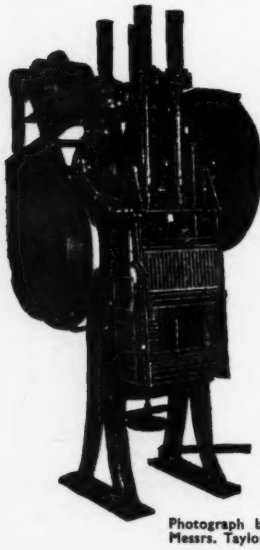

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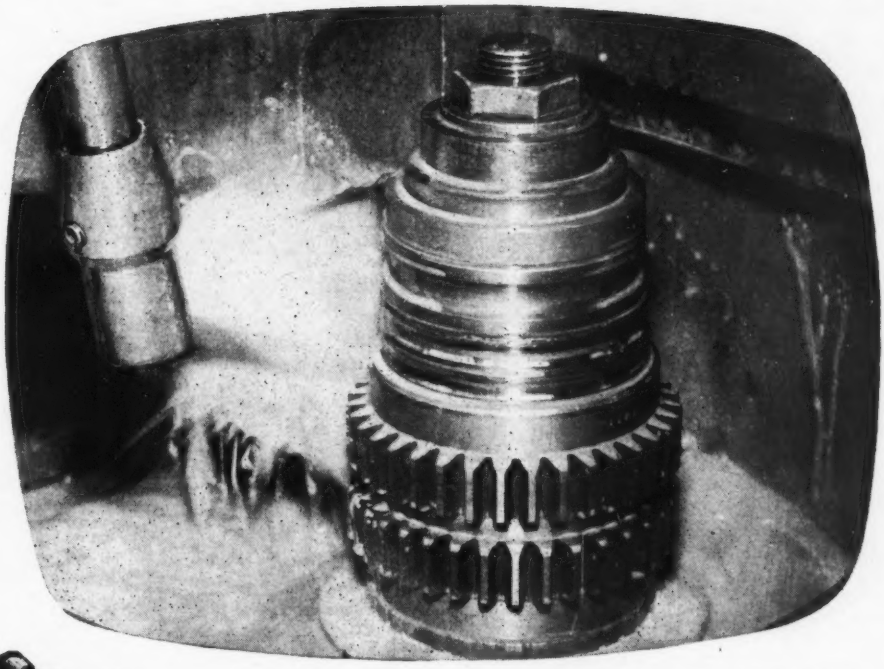

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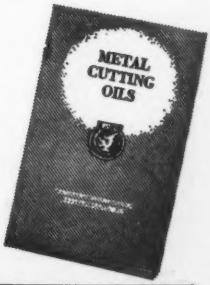

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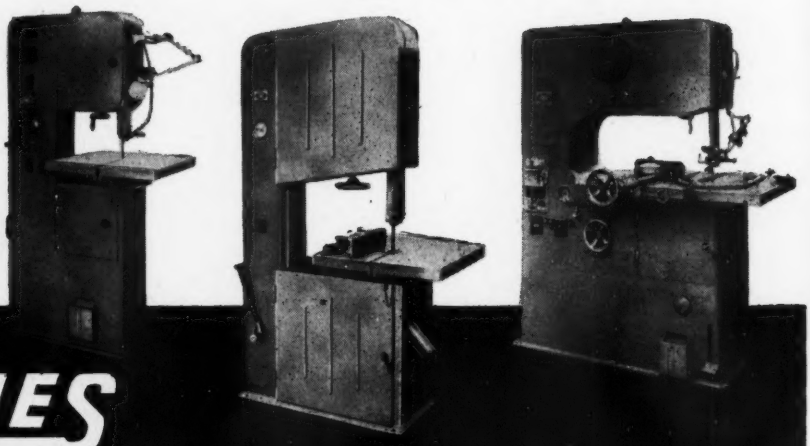

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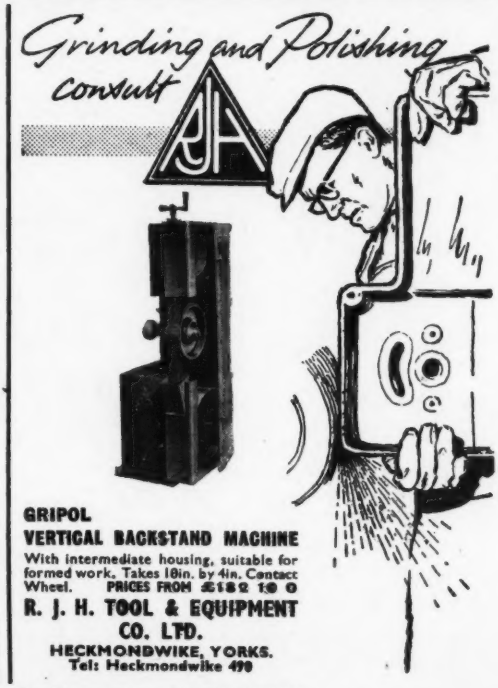

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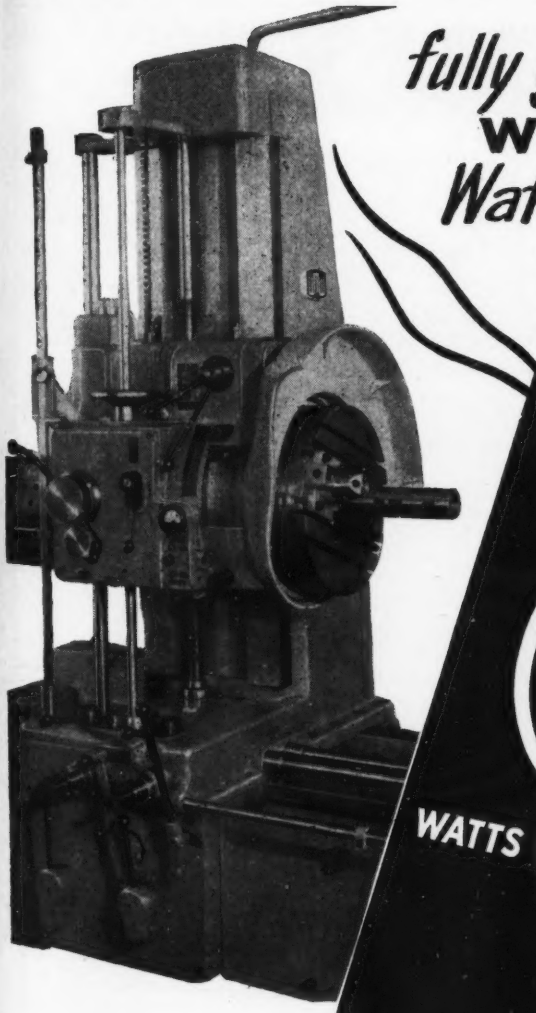

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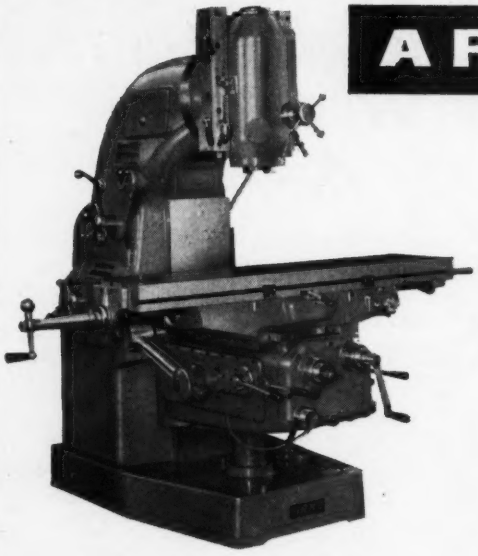

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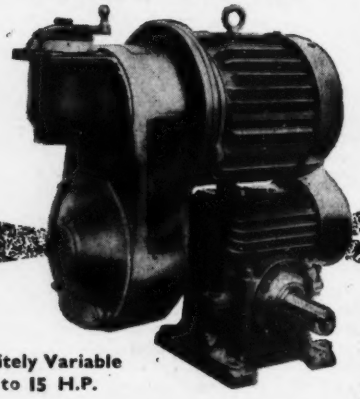

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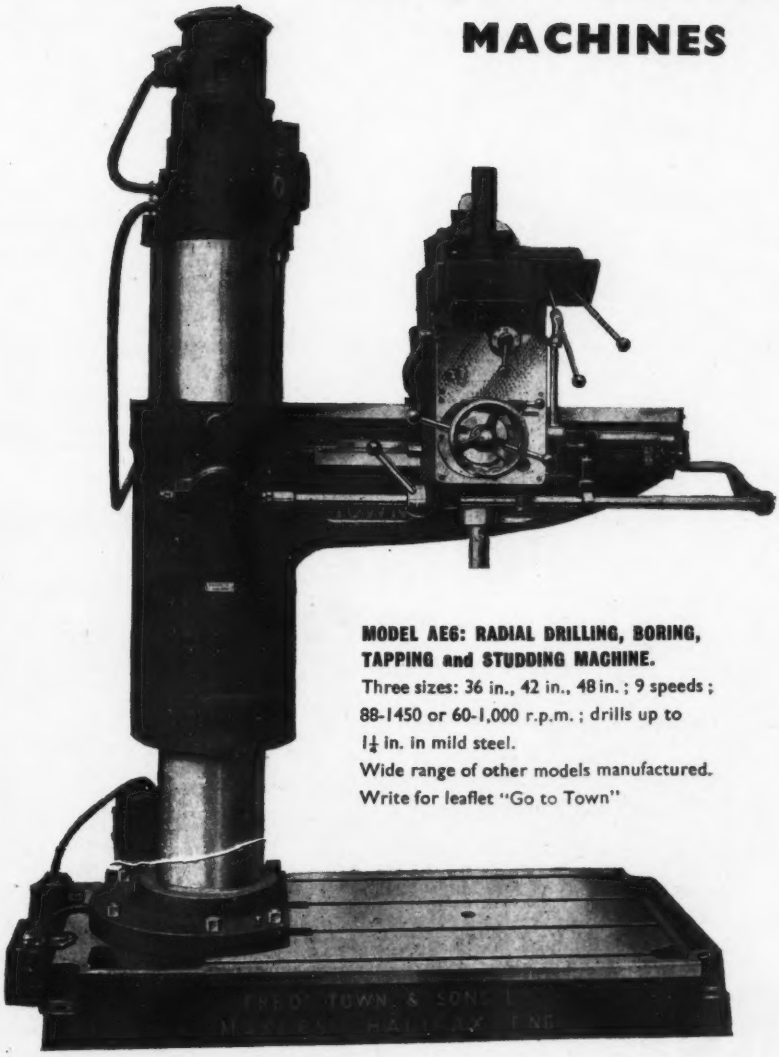

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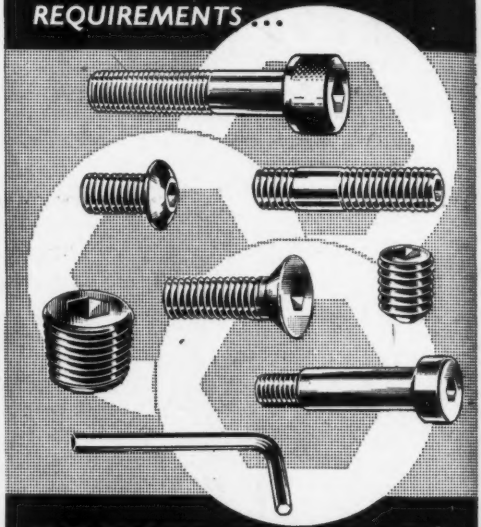

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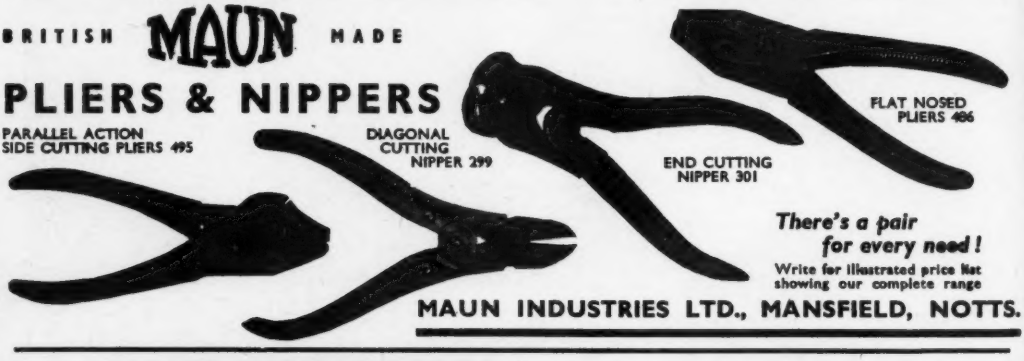

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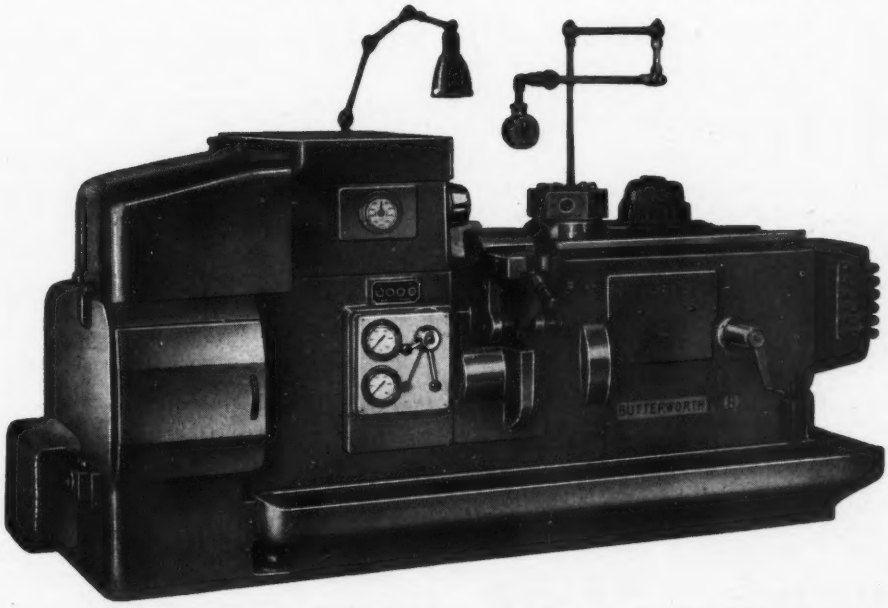

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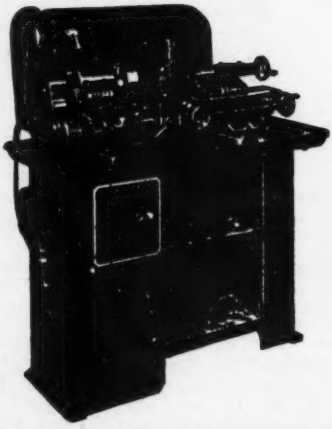

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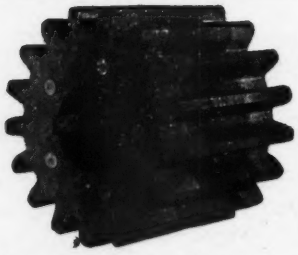

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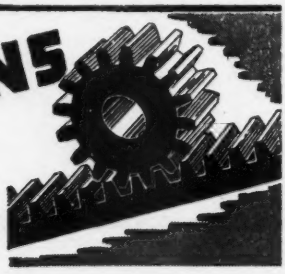

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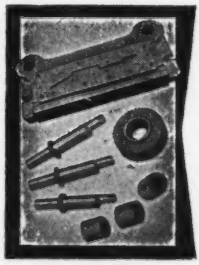

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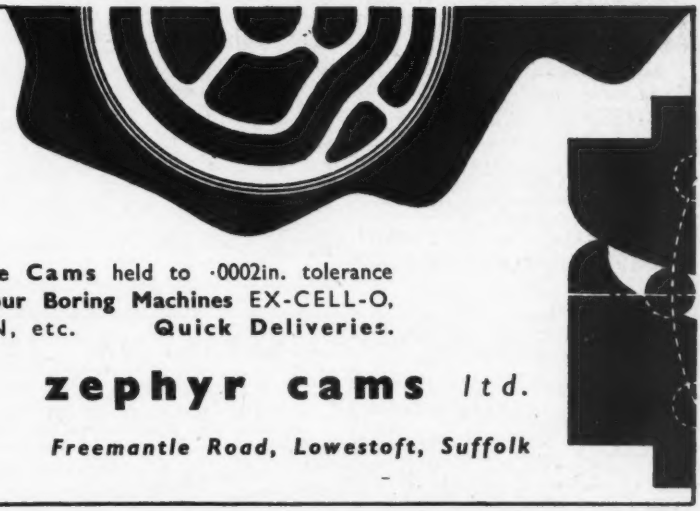

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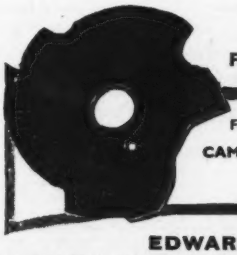

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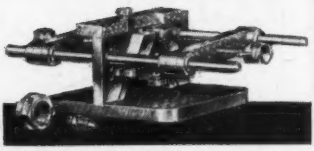

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Registered Patent Agent,
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City 6161. Booklet on Request.

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who has long been associated with the importing and distribution of a wide variety of machine tools, and is well known in the industry, proposes to establish his own Company in London. Would welcome the opportunity of taking care of the interests of reputable manufacturers of machine tools and ancillary equipment. Valuable connections in the U.K. and overseas markets. All offers will be treated in the utmost confidence. Please write:

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MACHINERY
Clifton House, Euston Road, N.W.1

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Agent. Old Established Company (London Area) requires Agent with entry to users of Mazak pressure diecastings in London and Southern England.—Write BOX D153, MACHINERY, Clifton House, Euston Road N.W.1.

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R. & J. PARK, LTD., Dominion Works, Chiswick, England. Export packers, shippers, and forwarding agents. Specialists in packing heavy machinery.

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Surplus Materials in New Condition 561ft. Prec. Gr. Steel 1¼in. dia. Nick. Chrome Moly. 1611-ft. Angle 3in. × 2in. × ⅛in. 2,275ft. Alum. Sht. 10ft. × 5ft. × .036in 17,500 sq. ft. St. St. Sheeting. 20.G. or ⅛in.—Messrs. T. & T. VICARS LTD., Engineers, Earlestown, Lancs.

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CYLINDRICAL GRINDING MACHINE. Minimum capacity 12in. × 72in., with variable speed workhead motor, quick approach and return mechanism to the Wheelhead, and variable Hydraulic table traverse. Capable of producing high quality surface finish and precision sizing. Required for advertiser's own use.—BOX D180, MACHINERY, Clifton House, Euston Road, N.W.1.

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Modern machines required in first class condition.
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Machine Tools, Power Presses, and Sheet Metal Machinery. Single machine or complete plant purchased. Immediate Inspection.—ALBERT EDWARDS (MACHINERY), LTD., 79/89, Pentonville Road, London, N.1.

MONFORTS Hydraulic Semi Automatic Lathe.
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We offer generous prices for your plant or accept in part exchange for modern equipment

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We pay cash for single machines or complete plants

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REINECKER Universal Relieving Lathes Model UHD. I.
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Slot Miller or Keyseater—Karl Hurth L.F.4. Table 48in. × 12in.
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Universal Grinder—Churchill P.A.W. 10in. × 24in.
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Vertical Surface Grinder—Snow V.18, 72in. × 15in. or 42in. × 15in.
Shaper—Butler 26in. Universal Table.
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Multi-spindle Drill—12in. adjustable spindle, ⅛in. or ¼in. capacity.
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250 ton Friction Screw.
150 ton double sided single geared—friction clutch drive, 72in. between sides.
35 ton open fronted inclinable, direct drive V.S.
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"Q. & S" 10B Standard Horizontal Bandsaw.
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HERBERT No. 4 Capstan Lathe. £235.
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MELBO 6in. × 6in. Hacksaw Machine. NEW. 400/3/50. £63 16s.
As above. S/Phase. £66 16s.

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15" × 11" × 4½" @ 108/- per doz. 18" × 12" × 6" @ 121/- per doz.
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Complete Installation With All equipment and furnaces—first class condition. Hydraulic Lead Pipe Press up to 5in. capacity. Double acting Hydr. Lead traps press and Lead Rolling mill, all gauges, standard width 1,000 mm. (39⅜in.).—Write: SCHUTTE, 51, Avenue Louise, Brussels, 5.

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Bullard Verticalauto, D-type, 8-spindle 16/23, double indexing. Complete with compound slides and chucks.—HENRY KIRK (MACHINE TOOLS), LTD., Yate, Bristol. Tel. Chipping Sodbury 3081.

Surface Grinder, New Harbot 18in. × 6in. hand traverse, £550. Also New Fortis Lathe, 6¾in. centres, £526. Both motorised 3 phase.

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Our stock includes Myford MG12 Grinders, Eagle Surface Grinders, Myford Lathes, Boxford AUD 4½in. Lathes, Willson 6½in. Lathes, Pacera Drilling Machines from ¼in. to 1¼in. capacity, Startrite Bandsaws, Kennedy, Rapidor and Q. & S. Hacksaw Machines, Centec Milling Machines, 18in. Alba Shapers, Vices and Rotary Tables of all types.
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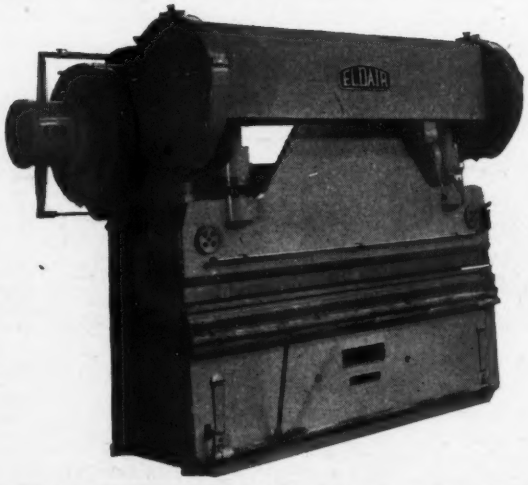
Capacity 8′ × ¼″ (EX-STOCK DELIVERY)

A thoroughly reliable overcrank machine, applying 110 tons pressure over a die length of 10ft. by $\frac{1}{16}$in. All parts are engineered to the highest standards, allowing constant ease of operation with minimum maintenance. A special feature is the simplicity with which accurate top beam settings can be achieved. Massively constructed for long life; weight about 11 tons. Many optional extras and variations available.



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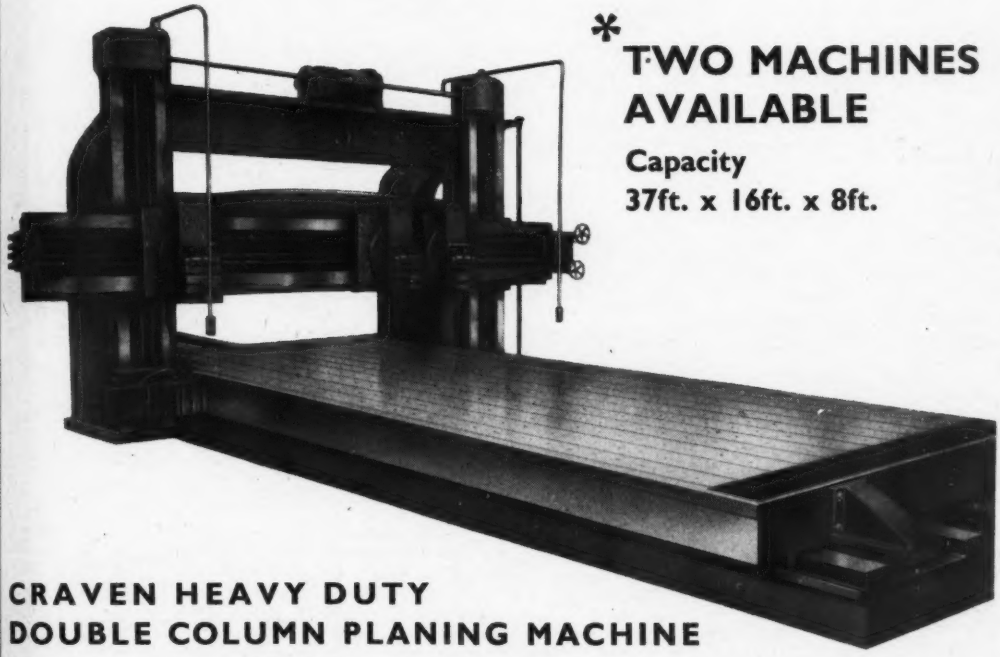

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Capacity
37ft. x 16ft. x 8ft.

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Double Column Planing Machine, fitted with three swivelling toolposts on power operated rise and fall crossrail. One swivelling sidehead on each column. Tee slotted worktable running on four 9in. wide shears. Auto and hand lubrication provided to bed and gearing. Double pendant control.
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Maximum height under crossrail: **9ft. 3ins.** Variable feeds ranging from: 15-75 f.p.m.
DRIVE. Variable speed motor drive consisting of Generator with control panel by Lancashire Dynamo and Crypto Ltd. Input 220 volts D.C. Output 480 volts D.C. to two 75 H.P. motors running at 240 volts D.C. Separate motor drive to side heads 220 volts D.C. 12½ H.P. motor giving power and rapid power traverse.
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VICTORIA Juniormil Plain Horiz. Mill.
VICTORIA V2 Vertical Mill.
VICTORIA U2 Rapidmil Universal Mill.
VICTORIA V3 Vertical Mill.
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STANLEY 8½in. × 6ft. b.c. S.S. & S.C. Lathe.

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JAKOBSSEN SJ16 32in. × 12in. Hydr. Surface Grinder.
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EXCEL No. 1 Pedestal Swing Head Grinder.

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MANCHESTER Rapidor 6in. Medium Duty Hacksaw.
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RICHMOND HB3/12 4ft. 6in. Arm Radial.
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Complete range of ¼in. and ½in. Bench and Pillar Drills by **FOBCO, PROGRESS, PACERA** and **KERRY.**
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RECENT ADDITIONS TO OUR USED MACHINE TOOL STOCKS

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DENBIGH C4 Horizontal Milling Machine.
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INVICTA 6M 24in. Stroke Shaper.
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TMA Model G3 Engraving Machine.

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NEWALL / KEIGHLEY ' L ' 12 by 24 External Grinder, complete with built in Wheel Dressing Compensating Valve.

MILWAUKEE Vertical Milling Machine, Model ' H ' 5ft. 3in. by 1ft. 3in.

HEALD 72A Internal Grinder.

NEWALL 836 Thread Grinder.

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All ex used stock

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Electric Motors, New and Secondhand, over 1,000 always available for sale, part exchange or hire. Prompt repairing service in event of breakdown.—JOHN RODWELL, LTD., Vicarage Road, Hornchurch. Hornchurch 48877 (3 lines).

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ACME GRIDLEY 1in. 6-sp. Automatic, 1947.

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Micromatic "Hydrohoner" Hydraulic Honer. Model H1. Auto cycle. Table 11½in. × 10in. W/8. Ind. motors. —WILCOX & CO., Barr Street, Birmingham 19. NORthern 1234/5.

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RYDERMATIC No. 12 Vertical Multi-Tool Lathe.

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FORST RIAS Universal Vertical Broach for internal and surface broaching. 5 tons, 39½in. stroke. 1952 machine.

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SNOW vertical spindle, rotary table 10in. dia. cup wheel, 24in. dia. elec. chuck.
BROWN & SHARPE No. 2 Surface.
New ALPA Surface, 32 × 8in.
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KEIGHLEY Type XL Hydraulic Plain Grinder, 6in. × 18in.
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LANDIS 12 × 48 Universal.
BROWN & SHARPE No. 3 Universal.
NORTON 14in. × 36in. Universal.

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LEICHTI PR Turret Lathe (Swiss).
GISHOLT Turret Lathes.
FOSTER No. 2B Turret Lathe.

CENTRE LATHES
SMART & BROWN Type M 4in. Precision.
HENDEY 6in. × 30in. Taper Turning.
MONDIALE 7in. × 60in. Gap Bed.
CROMWELL 3½in. Precision.

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WERNER No. 5160 Small Multipurpose. Vert. and Horiz. Table 22in. × 6½in.
ARCHDALE 14in. Manufacturing type.
CINCINNATI Type OK 18in. Horiz.
EDGWICK 18in. Horizontal.
ARCHDALE 20in. Twin Overarm Horizontal. Table 40in. × 10in.
KENT-OWENS 1-8 and 1-14 Hydraulic Production.
New TAYLOR Vertical, table 17½in. × 5½in.
HERBERT 23V Vert. Table 68in. × 17in. 48in. traverse.
HELLER Automatic Thread Millers (4).
ASQUITH HKO Duplex Keyseater.

PRESS
V. & O. No. 11 Double Action. Approx. 10 tons. Roll feed. Max. draw 1in.

A. machines motorised 400/3/50 unless otherwise stated.

ACBARS LIMITED,
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Telephone: RODney 7822.
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PENSOTTI 14in. Swivel Head Slotting Machine, 24in. dia. rotary table. Vernier calibrations.

PARKES (MACHINE TOOLS) LTD.,
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"Bertram" Power Double Geared Open Fronted Multiple Punching Machine for sale. Pressure approximately 180 tons. Stroke 4½in. Width between side frames 75in. Hole in bed 72in. × 2½in. Length of ram 78½in. Removable gap tie bars. Arranged motor drive 400/3/50. Weight about 10 tons.—F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham 3.

Classified Advertisements (*PLANT FOR SALE, contd.*)

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(Machine Tools) Ltd.

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Tel.: Maida Vale 1195/6.

'Grams: Emwarneers, Kilb., London.

LATHES

SOUTHBEND 14½in. × 36in. S.S. & S.C. Taper turning.
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LE BLOND 15RP S. & S., 15in. × 24in.
CRAVEN 36in. Swing × 12ft. Between S.S. & S.C.
SMART & BROWN 4in. × 18in. S.S. & S.C.
LANG 36in. Surfacing and Boring.
ACME No. 5W Capstan, chuck machine.
RYDERMATIC No. 12 Multi-Tool.
D.S.G. 13Z Minor S.S. & S.C.
WILLSON 6½in. × 36in. Gap Bed S.S. & S.C

CAPSTANS AND AUTOS

WARD No. 7 Capstan, chucker.
HERBERT 4B D/L chuck and bar feed.
HERBERT 2S air-operated chucker.
TAYLOR No. 1263 Capstan, ¼in. cap.

DRILLS

HERBERT Type "V" Junior Geared Pillar.
HERBERT Type "V" Pillar.
HERBERT Type "C" Pillar.
FOSDICK 4 BM. 3 spin. H/Sp.
CORONA 3M Pillar, 1½in. cap.
KITCHEN & WADE 2ft. 6in. Radial, 2in. capacity.
CORONA Model 9FX Super High Speed Bench.

GRINDERS

CHURCHILL BY. 10in. × 20in. "live" and "dead" workhead.
LUMSDEN 30R 4 wheel carbide tool.
KEIGHLEY KN Internal.
BROWN & SHARPE No. 5 Surface.
BROWN & SHARPE No. 23 Plain, cap. 10in. × 48in.
BROWN & SHARPE No. 2 Surface, cap. 6in. × 18in.
SMART & BROWN Internal, 1½in. cap.
BROWN & SHARPE No. 5, 3in. × 18in. Plain.
BALLINGER 10/24 "Versatile" Abrasive Cutting-off Machine.
NEWALL Model L.U. 10in. × 36in. Hyd. Universal.
B.S.A. LANDIS Type C 6in. × 18in. Hyd. Plain.
CHURCHILL Mod. H.C.B. Internal Auto Size.
HAHN & KOLB Hyd. Disc Lapping M/c.
JACKMAN No. 22 Disc, 18in. dia.
LUMSDEN Mod. 12M. Tool, 14in. × 2 wheel

MILLERS—Vertical

CINCINNATI Model 08 Production.
KENDALL & GENT Duplex Profile, table 18in. × 15in.

MILLERS—Horizontal

CINCINNATI No. 2 MH. Plain High Speed.
CINCINNATI Mod. 08 Plain Automatic.
BROWN & SHARPE No. 000 Plain Auto Miller.
BROWN & SHARPE No. 2 Universal, light type.
RICHMOND 2HS Plain, table 35in. × 9in.
ARCHDALE 20in., table 40in. × 10in.
ASQUITH H.K.1 Duplex Keyway, table 43in. × 10in.
CINCINNATI Mod. O.K. Prod., table 34in. × 12in.
ARCHDALE 14in. Plain, table 27in. × 8in.
ARCHDALE 28in. Plain, table 49in. × 13in.

SAWING MACHINES

EHJ No. 13 Filing and Sawing.

SHAPERS

TOWN 14in.
HERBERT N.D. 20in.
ORMEROD 14in.

GEAR CUTTER

MAXICUT Gear Shaper, Mod. No. 2.

MISCELLANEOUS

MANCHESTER Rapidor Saw, 6in. × 6in. NEW.
T.T. & H. Javelin Etchers, Multi-heads (3 m/cs.).
HEAP 2in. Screwing Machine.
BUTLER 36in. Open Side Planing Machine Table 48in. × 23in., with side box.

PARKES (MACHINE TOOLS) LTD.,

WITTON ROAD, BIRMINGHAM, 6

Tel.: EASt 1742

Siemens Schuckert Electrically Heated Furnace, 6ft. 10in. dia., 8ft. 10in. deep, 550 deg. C., 100 kW, 400 volts.
New Process 100 kV Seam Welder, 400/3/50.
British Federal 50 kVA Flash Butt Welding Machine. 400/3/50.
Fielding 50 ton hydraulic horizontal pipe bender, up to 6in. bore hydraulic tubes.
200 Ton Fielding Downstroke Hydraulic Press, 14in ram, 42in. stroke, 63in. daylight.
100 Ton Fielding ditto 10in. ram, 72in. stroke, 99in. daylight.
50 Ton Fielding ditto, 3ft. stroke.
Bliss 70 Ton Geared Double Sided Power Press. 400/3/50 supply.
3 Bliss No. 304 Vertical Single Action Drawing Presses, 7½in. stroke, 50 tons. American.
Bennie Punching, Shearing and Section Cropping Machine, 4½in. × 4½in. × ½in. angle.
Windsor 6-oz. Plastic Injection Moulding Machine.
Sedgewick Bending and Folding Machine, 6ft. × ½in., motorised.
8ft. × ½in. Bennie Bending Rolls.
7ft. × 1in. Craig Donald Flattening Rolls.
"Pyramid" Bending Rolls, 9ft. 0in. × ½in.
200 Tons Tangye Hydraulic Straightening Press, bed 25ft. × 3ft., stroke 21in., motorised travelling table, 2 ram pump.
Hugh Smith Double Table Scarfing Machine, 13in. fixed stroke, from 16in. to 8ft. wide, 1½in. thick steel plates.
Crow, Harvey Punch, Shears and Angle Cropper, 18in. blade, 27in. throat, heavy duty.
Pels Punch Shears and Cropper, 12in. blade, shear ½in. takes 6in. × 6in. × ½in. angles.
Robertson Shears, ½in. capacity, 10 h.p. 28in. blade, 9in. maximum opening. (Two.)
Berry Plate Guillotine, capacity 4ft. × 1in. 18in. throat, 30 h.p. motor.
New 1-cwt. and 2-cwt. Hammers by Massey and Alldays & Onions, also 3-5-cwt. secondhand E.O.T. Cranes.
30 Ton Marshall Fleming, 29ft. span, cab control.
25 Ton Clyde, 21ft. 9in. span, cab control 1954. Can convert any span to 95ft.
20 Ton Vaughan 42ft. 3in. span. Unused.
20 Ton Morris Goliath, 35ft. span, 5 ton auxiliary.
10 Ton Heywood, 34ft. span. Unused.
10 Ton Morris 32ft. 10in. span, cab control
10 Ton, 60ft. span. 1955. (Two.)
5 Ton, 37ft. span. 1944.
3 Ton Morris, 149ft. span. 1954.

FRED WATKINS (ENGINEERING), LTD., Coleford, Glos. 'Phone: Coleford 2271 (5 lines).

35ft. Redman Planing Machine, Ward-Leonard AC/DC drive, complete with switchgear.—BOX D154, MACHINERY, Clifton House, Euston Road, N.W.1.

NEW MACHINE TOOLS FROM STOCK

EARLY DELIVERY

MITCHELL OF KEIGHLEY 8½in. Type DMS Gap Bed Lathe, by 5ft. 3in. B.C. 400/440/3/50. Instant delivery.
VICTORIA No. 2 Rapidmil Universal Milling Machine. Table size 48in. × 11¼in. 400-440/3/50. Instant delivery.
VICTORIA No. V2 Vertical Milling Machine. Table size 45in. × 11in. 400-440/3/50. Instant delivery.

CENTAUR TOOL WORKS,

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Tel. EDGbaston 1118 & 1119. 'Grams Capstan, Birmingham

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B. ELLIOTT (MACHINERY) LTD

VICTORIA WORKS, LONDON, N.W.10

Tel. ELGAR 4030

Edgwick Vertical Surface Broacher. Slide 60in. × 12in. Table 14in. × 14in. Motorised.—WILCOX & CO., Barr Street, Birmingham, 19. Northern 1234/5.

K·E·N·T

PRESSES

Hammerle 60 ton Hydraulic Press, 14in. max. stroke, 28in. × 36in., table as new.
C.V.A. 10 ton Dieing Press.
Rhodes Incl., 25 ton.
Weingarten Incl., 30 ton.
Edwards Incl., 18 ton, Var.
Hi-ton 3 ton Hydraulic.
Edwards 4 ton, Var.

LATHES

8½in. Holbrook Model B Collets.
8½in. Pratt & Whitney.
14in. × 14ft. Betts Bridgeford.
18in. × 12ft. D.S. & G. S. & S. only.
Student 6in., with equip.
Le Blond 7½in. Gap Bed.

MILLING MACHINES

Vertical

Archdale 18in., 40in. × 10in.
Herbert 15S, 49in. × 11in.
Jason SI and Sw head.

Horizontal

Archdale 20in.
Reiden H.F. 30, 60in. × 14½in.
Archdale 14in. Hor.

CAPSTAN AND TURRETS

Ward 7 Capstan, covered bed.
Ward 7 Comb. lathe.
Murad 34 ½in. Capstan Lathe.
Modern 1½in. Capstan Lathe.

GRINDERS

Brown & Sharpe No. 2 Surface.
Robot No. 2.
J. & S. Univ. and T. & C.
Abwood Vertical Surface.

DRILLING MACHINES

Archdale 4ft. Radial, 2in. cap.
K. & W. 3ft. 6in. Radial, 1½in. cap.
Corona 2 spindle 3 M.T., power feed.
Archdale Vert. drill with floating table.

MISCELLANEOUS

Holroyd AN6 Thread Mill.
Artos Cutting-off Machine.
Alba 14in. Shaper.
Invicta IM Shaper.
Hutto Vertical Honer.
Newall Lapper.
Electricar Truck and charging panel.
Tauco Abrasive Cut-off.
"Orr" Abrasive Cut-off Sliding table.

All motorised 400/3/50.

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Classified Advertisements (*PLANT FOR SALE, contd.*)

AUTOS

CONOMATIC 1¼in. 8-spindle Type W.W.
WICKMAN 2¼in. 5 spindle Auto. 1941 machine.

BORERS

UNION Model BFT 100/11. 4in. spindle.

DRILLING

ASQUITH 4ft. O.D.1 Radial Drill.
PROGRESS 5E Round Table.
ARCHDALE 28in. Heavy Duty Pillar Drill.
NEW—**MAS** Model V.R.2, 3ft., Elevating Arm Radial Drill.
MAS Model V.R.4, 4ft. 6in., Elevating Arm Radial Drill.

LATHES

SOUTHBEND 16in.
EDGWICK 7in.
DEAN, SMITH & GRACE. Height of centres 7in.
MONARCH 22M, S.S. Taper Turning Lathe.
WARD 10 Combination Turret Lathe.
WARD 7 Combination Turret Lathe.
LANG 10½in. Gap Bed. 5ft. between.

MILLING

28in. **ARCHDALE,** Rapid all ways.
18in. **EDGWICK** Production Mill.
CINCINNATI No. 5 High Power Plain Hor. 1942 machine.
MILWAUKEE 2 HL Vertical—rebuilt.
MILWAUKEE 2K Plain—overhauled.
MILWAUKEE 3KM Universal, metric, with dividing head.
PEGARD Bed Type Vertical, table 84in. × 29in.—slightly used.
KENDALL & GENT Model C.V.M. 25.
NEW—**GIEWONT** Model F.Y.C. 25 No. 2 Vertical Miller, 44 × 10in. table. Delivery mid-October.

GRINDING

NEW—**RIBON** Model R.V.R.1000, 10 × 40in.

SHEETMETAL

GUILLOTINES
TRIUMPH 6ft. × ⅛in. Overcrank.

All machines motorised 400/3/50

STANCROFT LTD.,
BEDWORTH ROAD, COVENTRY.
Telephone Coventry 88072/3.

LANG 15in. S.S. & S.C. Gap Bed Lathe, geared head, 60in. between centres.

PARKES (MACHINE TOOLS) LTD.,
WITTON ROAD, BIRMINGHAM, 6
Tel.: EASt 1742

ONE (NEW)
MIKRON 122
UNIVERSAL GEAR HOBBER
(Capacity 1¼in. Diam.)
AVAILABLE EX-SWISS WORKS
Sole U.K. Agent
HENRY TURNER (Machine Tools) LTD.,
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BALham 8585

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FOR GOOD CLASS SECONDHAND MACHINES AT LOW COST

B.S.A. No. 48 Automatic.
C.V.A. No. 8 Automatic.
C.V.A. No. 20 Automatic.
WARD 1A-2A Capstans.
BROWN & SHARPE No. 2 and No. 5 Surface Grinders.
CHURCHILL 18in. by 6in. Surface Grinders.
BROWN & SHARPE No. 1 and No. 2 Uni. Grinders.
STUDER Type 'O' Plain Grinders.
LANDIS No. 1 Universal Grinder.
ATIEFFE Cutter Grinder. A.V.40.
FRITZ WERNER 270A Cyl. Grinder.
PRATT WHITNEY 16in. by 36in. S.S. & S.C. Lathe.
PRATT & WHITNEY 12in. by 30in. S.S. and S.C. Lathe.
MONARCH Mod. 'C' 12in. by 54in. S.S. and S.C. Lathe.
HARRISON 4½in. Lathe.
SOUTHBEND 14½in. Lathe.
SENTINEL CRIDAN Thread Chasing Lathe (1954).

CINCINNATI 08 Vertical Mill.
K & T No. 5HM Vertical Mill 1,300 r.p.m.
K & T 4H Horiz. Mill.
CENTEC 3R Hor. Mill.
MANN Thread 6ft. B.C. Mill.
SCHULER 20/140 Power Press.
TAYLOR & CHALLEN No. 63 40T Power Press.
ESSEA 6T and 10T Power Presses.
BLISS 18 Power Presses.
SENTINEL 25T Power Presses.
KELLER 1210 Diesinking Machine.
RHODES 10ft. by ¼in. Hydraulic Shear.
RHODES 6ft. by ¼in. Guillotine.
BLISS No. 39 Horning Press.

LATE AMERICAN MACHINES
GLEASON 12in. Str. Bevel Gear Generator.
FELLOWS 6IA High Speed Gear Shaper.
GLEASON No. 16 Spiral Bevel Hypoid Gear Generator.
FELLOWS 612 High Speed Gear Shaper.
HEALD No. 22 Ring & Surface Grinder.

All machines motorised 400/3/50 unless otherwise stated.

GOOD USED MACHINE TOOLS WANTED

E. H. JONES
MACHINE TOOLS LTD.
48 HIGH STREET, EDGWARE, MIDDX.
PHONE EDGWARE 4488/9
78, WRENTHAM STREET, BIRMINGHAM 5, *Phone Midland 5593*

HIGH QUALITY USED MACHINE TOOLS

EDGWICK No. 2 Horizontal Plain Milling Machine. Table size 46in. × 11in. 400/3/50.
HERBERT No. 1 Horizontal Milling Machine Table size 26in. × 8¼in. 400/3/50.
ORMEROD 20in. Stroke Heavy Duty Shaping Machine. 400/3/50.
TOWN Shaping Machine. Max. stroke 19in. 400/3/50.
CLIFTON & BAIRD 22in./24in. Mechanical Cold Sawing Machine. Self-contained motor drive, 10 h.p. motor, 400-440/3/50.
Used **PRECIMAX** Type UPJ12/72 Hydraulic Universal Cylindrical Grinding Machine with variable speed workhead and electrics to suit 400/3/50.
HERBERT No. 12 Heavy Duty Combination Turret Lathe. Full chucking equipment. 400/3/50.
TOWN 28in. Vertical Spindle Drilling Machine. Compound table. 400/3/50.
K. & W. 33in. Sensitive Radial Drilling Machine. Swing-aside table, swing-aside arm. 400/3/50.
JONES & SHIPMAN 20in. Vertical Drilling Machine. No. 4 Morse Taper. Power feed. 400/3/50.
KEARNS No. 2 Standard Horizontal Boring Machine with facing head and sliding spindle. 400/3/50.
SNOW T20 Table Surface Grinding Machine.
WE UNDERTAKE REBUILDING OF ALL TYPES OF MACHINE TOOLS

CENTAUR TOOL WORKS,
EYRE STREET, SPRING HILL, BIRMINGHAM, 18.
Tel. EDGbaston 1118 & 1119 'Grams Capstan, Birmingham

NEW MACHINES EX-STOCK

PERRIN AV2 Jig Borer with Co-ordinate Optics.
VICTORIA U2 Rapidmil.
VICTORIA Juniormil.
INVICTA 24in. Major Shaper.
ALBA 4S Shaper.
TOWN Radial, 1¼in. capacity.
PILOT No. 7, 12-ton Press.
BINNS & BERRY Lathe, 12½in. × 7ft. 6in. b.c.
CARDIFF Lathe, 11in. × 6ft. 8in. b.c.

Early Deliveries—LATHES

COLCHESTER 6in., 7½in., 8½in.
WOODHOUSE & MITCHELL 7in. × 3ft. b.c.
WOODHOUSE & MITCHELL 8½in.
WILLSON 7½in. × 3ft. b.c.

R. KELLY & SONS LTD.,
LIVERPOOL—ROY. 4463.

Landis 10in. × 24in. Type "C," Universal Grinder. Internal Attachment. New condition.
Further details from:—
C. & G. OLDFIELD, LTD.,
15, Abercorn Street,
PAISLEY.

Van Norman Radius Grinder. To take 2in. dia. × 1in. wide components. Continuous feed model. Ind. motors.—WILCOX & CO., Barr Street, Birmingham 19. Northern 1234/5.

Eye Bending Machine For Sale. For forming an eye in the end of rods or bars from ⅛in. to 1in. diameter. By "Williams, White & Co., U.S.A." Size No. 22. Weight about 20 cwts. Photo., etc., from F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham 3.

Classified Advertisements (*PLANT FOR SALE, contd.*)

GORTON 9J Copy Miller, 1942.
NEW BRITAIN GRIDLEY 61 1¼in. and 2¼in. Six Spindle Autos, Late (4 available).
WICKMAN 1¼in. 5 Spindle Auto, late, 2 available.
B.S.A. ACME GRIDLEY ¾in. 4 Spindle Autos., 3 available.
ACME GRIDLEY 2¼in. 4 Spindle Auto.
INDEX OR 12 & 12 SS Autos.
EDGWICK Type A 1611 Diecaster.
SIDNEY 36in. swing × 144 Lathe.
REED PRENTICE 1½ G Diecaster.
GRIDLEY Type L 5in. Auto.
LE BLOND No. 2 Deep Hole Drill.
ELECTRAULIC VBH, 15 ton Broach.
BLANCHARD 18 Surf. Grinder.
VICTORIA US Monotrol-Univ. Miller, 1953.
CONOMATIC 8 sp. 1¼in. Bar Auto.
BROWN & WARD ¾in. and 1¼in. Autos.
WARD 9A Capstans.
HERBERT 4 Senior Capstan.
CLEVELAND 1 3/16in., 1¼in., 2in., 2¼in., 3¼in. Autos.
MASSEY 5 cwt. Press Hammer, 1942.
Three **UNION** ¾in. Pedestal Drills. NEW.
BULLARD 16in. 6-sp. Mult-au-Matic, 1943.
GLEASON 12in. Bevel Gear Generator.
FELLOWS 61A, 645A Gear Shapers.
BRYANT 16-38 Internal Grinder.
HEENAN-FROUDE Baling Press, 1947.
SCHULER Vertical Dieing Press.
HERBERT 9S Turret Lathe.
MILWAUKEE 2H Plain Miller.
BLISS 304A 50 ton Press, 4in. stroke.
NORTON 14 × 72 Univ. Grinder.
BROWN & SHARPE No. 3 Univ. Grinder.
DEFIANCE 25A Horizontal Borer.
ARCHDALE 38in. Sens. Radial Drill.
NEWALL type L 10in. × 48in. Grinder, 1942
HEALD 72A Internal Grinders (3).
NORTON 12 × 36 Universal Grinder.
WARNER & SWASEY 3, 5 and 2A Turrets.
PRATT-WHITNEY 12B 2-sp. Profiler, 1941.
EDGWICK No. 2 Universal Miller.
CHURCHILL No. 1 Planetary Grinder.
ORCUTT HM24 Gear Grinder, 1944.
GISHOLT 1L, 2L turret lathes, 1941-43.
GRIDLEY Model R, 2¼in. cap. 4-sp. Auto.
ARCHDALE 18in. and 30in. Vert. Mill, 1942.
MONARCH Copying Lathe, 1946.
CHURCHILL PBH 12 × 36 Univ. Grinders.

All modern fully motorised machines.

HUNDREDS MORE

J. B. MACHINE TOOL CO., LTD.,
312/4, BRADFORD STREET,
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BOEHRINGER RAIL-POINT & BILLET PLANER

49in. × 32in. × 26ft.

167 H.P. WARD-LEONARD DRIVE

6 months delivery ex-works.

SYKES MACHINE TOOL CO. LTD.
The Hythe, Staines, Middlesex
Telephone: Staines 55474

HERBERT Model OV Swivel Head Vertical Milling Machine, speeds 250 to 2,000 r.p.m. Table 18in. × 5in. W.S.

PARKES (MACHINE TOOLS) LTD.,
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Tel.: EASt 1742

No. 9 Herbert Turret Lathe. Complete with starter, motor built in, bearings and slideways, overhauled. £400.—ENFIELD TOOL MANUFACTURING CO., LTD., Alma Road, Ponders End, Middlesex. Telephone: Howard 2774.

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ABBOT ST., KINGSLAND HIGH ST.,
DALSTON JUNCTION,
LONDON, E.8.

TERMS ARRANGED

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8ft. 16 gauge Hand Folding and Bending Machine. £200.
6ft. by ¼th Heavy Duty Power Folding and Bending Machine with 400/3/50 motor. £175.
EDWARDS 36in. 16 Gauge Cramp Folder £45.
EDWARDS 48in. 14 Gauge Power Guillotine, 400/3/50. £250.
36in. 18 Gauge Production Guillotine, continuous operation, 400/3/50. £85.
EDWARDS 42in. 18 Gauge Treadle Guillotine. £47 10s. 0d.
36in. ditto. £36.
30in. ditto. £30.

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35 GREENWICH CHURCH ST.
LONDON. S.E.10 GRE.1222

CAPSTAN LATHES

WARD No. 7, covered bed.

TURRET LATHES

WARD No. 7, covered bed, collet head and bar feed.
WARD No. 16, covered bed, 8½in. spindle, 32in. 4-jaw chuck, rapid and power feeds to saddle, cross slide and turret, power rotating turret, spindle speeds 7-225 r.p.m., 50 h.p. motor.
WARD No. 10B, covered bed. 4½in. spindle power rotating turret, power and rapid feeds to turret only, collet head and bar feed.

HORIZONTAL MILLERS

CENTEC Model 3R Electronic Control 29in. by 11in. table. Speeds up to 3,000 r.p.m., auto cycle with automatic elevation to head.
SUNSTRAND No. 2 Electro Mill, auto. cycle, 12in. by 54in. table.
HERBERT No. 3ND. Plain.
EDGWICK No. 2, 11in. by 42in. table, No. 40 steep taper.
JONES & SHIPMAN duplex slot miller. Hydraulic feed.

VERTICAL MILLERS

WADKIN high speed for light alloy, 16in. by 40in. table.
HERBERT 15S 10in. by 48in. table, sliding head.

GRINDING MACHINES

BROWN & SHARPE No. 2 Surface Grinder, 18in. by 6in.

TAPPING MACHINES

HERBERT No. 2 Flash Tapper, ¾in. capacity.

All machines motorised 400/3/50 unless otherwise stated.

One Secondhand Scrivener No. 1 Centreless Grinding Machine, maximum capacity 1¼in. diameter with Plunge Feed. Hand Operated. Motorised 400-440/3/50.
C. & G. OLDFIELD, LTD.
15, Abercorn Street,
PAISLEY.

JER

LATHES

DENHAM S.S. & S.C. Lathe, 10½in. × 6 ft. 6in. heavy duty, fully motorised. £750.
WILLSON 7½in. × 3ft. 2in., excellent, choice of two. £450.
DEAN SMITH & GRACE 13Z. £250.

MILLING MACHINES

BIERNATSKI H4 Vertical, 6ft. 1¼in. × 18in. S.P.D. £350.
EDGWICK No. 2 Horizontal, 46in. × 11in. £375.
HERBERT No. 8 Vertical, Cone Drive, excellent. £650.
BROWN & SHARPE 2YB. 34in. × 11in. £285.

GRINDERS

ABWOOD TH2AP. AS NEW. £250.
WRIGHT Table Surface with extractor. £95.

SHAPERS

INVICTA 4M 18in. AS NEW. £350.
TORPEX 22in. Single Pulley Drive. £175.

PLANING MACHINES

REDMAN 8ft. × 3ft. × 3ft. two belt, self-contained, motorised. £425.

SLOTTING MACHINES

WILKINSON 10in. stroke, cone drive, power feed to circular table. £95.

BORERS

ZIMMERMAN 2½in. Spindle, 31½in. × 22in. table. £675.

DRILLS

STOREY "25" 3 M.T., Motorised. AS NEW. £175.

J. E. RAISTRICK LTD.,
RELIANCE WORKS,
POYLE TRADING ESTATE,
COLNBROOK, SLOUGH, BUCKS.
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NILES-POND 60in. Double Column Borer.
PETERMANN No. 2 Prec. (Ped.) ¾in. cap. Gear Cutter.
WILKINS & MITCHELL Mod. 1,200-ton, 4-column, Stroke adj. max. 30½in., Power Press.
RHODES Model 600 800-ton Knuckle Joint Coining and Embossing Press.

NORMAN E. POTTS
(MACHINERY) LTD.
151/154, Sandy Lane, Birmingham, 12.
Tel.: VIC. 1278.

ARTER 16in. ROTARY TABLE MAGNETIC CHUCK SURFACE GRINDER.

Late type machine.

F. J. EDWARDS LTD.,
359-361, EUSTON ROAD, LONDON, N.W.1
Telephone: EUSton 5000. Telex No. 24264

And at Lansdowne House,
41, Water Street, Birmingham, 3.
Telephone: Central 7606-8.

Classified Advertisements (*PLANT FOR SALE, contd.*)

Newman

AUTOMATICS

BULLARD Multi-Au-Matic 7in. 8 spindle.
BULLARD Multi-Au-Matic 12in. 6 spindle.

BORING MACHINES

WETZEL Horizontal Boring and Facing Machine 7in. diameter travelling spindle, 45in. diameter facing head. (Two available.)
KEARNS Model OB Horizontal Boring and Facing Machine, 2½in. diameter travelling spindle (1957).
UNION Model BFT100 Horizontal Boring and Facing Machine, 4in. diameter travelling spindle (1955).
KEARNS Model OC Horizontal Boring Machine, 3in. dia. travelling spindle.
KEARNS No. 4 Horizontal Boring and Facing Machine, 4in. diameter travelling spindle.
WEBSTER & BENNETT Vertical Boring Machine, table 50in. diameter.
RICHARDS Type PRT Horizontal Floor Boring Machine, 3¼in. travelling spindle, 28in. diameter facing head.

CAPSTAN AND CENTRE LATHES

CHURCHILL-REDMAN Model 13NM Heavy-Duty S.S. & S.C. Gap Bed Centre Lathe, 13in. centre height × 72in. between centres. 8wing in gap 50in.
MITCHELL Model DM10 S.S. & S.C. Gap Bed Centre Lathe, 10¼in. centre height × 7ft. 5in. between centres. (NEW.)
OLDFIELD & SCHOFIELD Surfacing and Boring Lathe, 10¼in. centre height.
WARD 7B Combination Turret Lathe.
NILES Heavy Duty Centre Lathe, S.S. & S.C. 17in. centre height × 28ft. between centres.
U.L.R.O. Heavy Duty Centre Lathe, 16in. centre height × 30ft. between centres.

DRILLING MACHINES

HETTNER Radial Drilling Machine, 10ft. elevating arm.

GEAR MACHINES

ORCUTT Model HM24 Hydraulic Internal Gear Grinder.
GLEASON 3in. Straight Bevel Gear Generator.

GRINDING MACHINES

CRAVEN Roll Grinding Machine, capacity 20in. swing × 138in. between centres.
CHURCHILL Model HBY Internal Grinding Machine.
CHURCHILL Plain Cylindrical Grinding Machine, 26in. swing × 84in. between centres (1951).
LANDIS Type C Plain Hydraulic Cylindrical Grinding Machine, 6in. swing × 18in. between centres.
ORCUTT Model HM24 Internal Spur Gear Grinding Machines.
CHURCHILL Plain Hydraulic Cylindrical Grinding Machine, 20in. swing. × 72in. between centres.
BROWN & SHARPE Plain Cylindrical Grinding Machine, 10in. swing × 36in. between centres.

MILLING MACHINES

CINCINNATI Model 5/72 Plain Hydromatic Milling Machine, table 91in. × 22in. (1952).
CINCINNATI No. 2L Plain Horizontal Milling Machine, table 52in. × 10in.
CINCINNATI No. 1M Vertical Milling Machine.
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WICKMAN Grinding and Lapping Machine. Model 14C. Takes 1 grinding wheel 14in. by 2in. and lapping wheel 14in. by 2in. Two canting work tables 31in. by 19in. M.D. 400–440/3/50. Suds pump, etc.

LELAND-GIFFORD 4 spindle Drill. T-slotted table 72in. by 22½in. All spindles bored No. 3 M.T. with 8½in. traverse. 16½in. between spindle centres. One spindle with power feed. Centre to back 12in. 8 speeds 165–1,500 r.p.m. M.D. 220/3/50 with transformer for 400/3/50.

EDGEWICK Centring Machine. Single ended. Centre height 6½in. 3 spindle speeds by V cone pulleys. Bar vise to take up to 6in. dia. bar. Max. distance vise to chuck 37in. M.D. 220/440/3/50.

WARD 2A Capstan Lathe. Swing over bed 11¼in.; swing over cross slide 6½in. A.G.H. 6 speeds 71–1,531 r.p.m. Spindle bore 1⅜in. Power to turret. M.D. 400–440/3/50.

HILMOR Type C.1 Tube Bender. Non-Mandrel type. For steel tubes up to 2½in. dia. Hand operated.

BLISS No. 18C Inclinable Power Press. Tonnage rating 8. Fixed stroke. Bed to ram guides 8½in. Bed 15in. by 11in. by 9in. by 5in. hole. Hole in ram 1½in. Bolster fitted with 8 station indexing attachment. M.D. 400/3/50.

SWEENEY & BLOCKSIDE No. 7 Inclinable Power Press. Tonnage rating 10. Fixed stroke 1in.; adjustment to position 2in. Bed area 18½in. by 12in. M.D. 400/3/50.

GRAHAM & NORMANTON 20in. Crank Shaper. V-belt drive from 5 h.p. motor. 9 ram speeds.

H. BELL (Machine Tools) LTD., Walter Street, LEEDS 4.

Kitchen & Wade G.5 6ft. Girder Radial, 3 Feeds and 3 Speeds. Machine No. 13642. Further details from: C. & G. OLDFIELD, LTD., 15, Abercorn Street, PAISLEY. Member of B.A.M.T.M.

NEW MACHINES FOR IMMEDIATE DELIVERY

MAS VRM 50A Portable Universal Radial Drill. Capacity 2in. Arm swivels through 360°.

WALTER AMS 500 Automatic Cutter Head Grinder, cutter capacity 3½in.-20in. diameter.

CARDIFF 11in. by 48in. S.S. & S.C. Lathe.

HECKLER & KOCH Model GFI Automatic cycle Production Miller. Table 7in. by 19½in., spindle speeds 190-3,000 r.p.m.

WEBO Model GK 12 Controlled pitch Tapping Machine, capacity in steel ½in. dia.

ELGAR MACHINE TOOL CO. LTD.

172-178 VICTORIA ROAD, ACTON, LONDON, W.3.

Telephone: ACOrn 5555 (7 lines)

SOAG OFFER:-

USED METAL PLANERS

6ft. by 5ft. by 20ft. **STIRK** "HILOPLANE," 4 Tool Heads, Stirk Splitfield Drive.

6ft. by 6ft. by 18ft. **LIBERTY,** 4 Tool Heads, A.C./D.C. Generator Set. Rapid traverse motors and P.B. Control.

4ft. by 4ft. by 10ft. **LOUDON,** 3 Tool Heads, Generator Set and pendant Control.

3ft. by 2ft. 6in. by 8ft. **SWIFT-SUMMERSKILL** type 36M all electric, 3 tool heads, Solenoid tooling, 1952.

16ft. by 10ft. 6in. **SHANKS,** Horizontal and Vertical Planer (Wall Type Planer) A.C./D.C. Generator set.

FROM STOCK OR EARLY DELIVERY

Full details from:

SOAG MACHINE TOOLS LTD.

Juxon Street Lambeth, London S.E.11.

Phone: RELiance 7201.

Grams: SOTOOLSAG, LONDON, S.E.11.

Gordon Try Ltd

MEMBER OF THE B.A.M.T.M.

NEW MACHINES

COLCHESTER STUDENT, TRIUMPH MASCOT LATHES

WILLSON MR. V 7¼" by 36" Lathe.

W. & M. 70 Junior Lathe.

WILLSON MR.1 16½" by 24" Lathe.

MYFORD Super 7 Lathe.

ACORN Hi-Lo ¾" Capstan.

DENBIGH D 4 Uni. Mill.

CENTEC 2 B Uni Mill.

PROGRESS 16, 1S, 2a, 3a.

DRILLING MACHINES

EXCEL No. 1 Surface Grinder.

EAGLE Model 3 Surface Grinder.

BURDETT No. 70 Surface Grinder.

EXCEL No. 5 Tool and Cutter Grinder.

THE CAUSEWAY, EGHAM, SURREY

Tel: Egham 4166/7

Mitchell 8½in. S.S. & S.C. Gap Bed A.G.H. Lathe with 3in. Hollow Spindle. Speed range 30-400 r.p.m. Further details from:

C. & G. OLDFIELD, LTD. 15, Abercorn Street, PAISLEY.

Member of B.A.M.T.M.

Brown & Sharpe No. 5 Cyl. Grinder, 400/3/50, 4in. × 20in. power feeds, also Jones & Shipman 8in. × 10in. hand feeds. Good cond.—C. L. THOMAS, LTD., Stirling Road, Solihull. Tel.: 3075-6.

Classified Advertisements (*PLANT FOR SALE, contd.*)

MACHINES NOW IN STOCK

AUTOMATICS

MANURHIN Type PDI2A Automatic with Hopper feeds for parting off and chamfering Cartridge Case heads. 5 machines. (These nearly new machines may be adapted for other work and are offered at the lowest price.)
RYDERMATIC No. 18 Vertical Automatics 60 H.P.

BORING MACHINES

MATHEYS Model FPN/28 Semi Jig Borer. (1956.)
PADDON Mk. 3 type WP Cylinder Re-Boring Machines.

HONING AND LAPPING

WOLTERS Model 1.L.I. Hydraulic Internal Lapping Machine.
DELAPENA Honing Machine.

CAPSTANS AND TURRET LATHES

BOLEY-LEINEN Model ER 15 ¾in. Capstan (Modern) (1953).
HERBERT No. 2 Pre-optive Bar Turret Lathe. Flamard bed, 2in. capacity with bar feed, full turret tooling.
HERBERT Model 22A Turret Lathe. 8¼in. Spindle Hole.
LIBBY 2H 8in. spindle Turret Lathe.

CENTRE LATHES

Two **WILLSON** 7¼in. Newel Lathes.
SOUTHBEND 7in. Centre Lathe.
CRAVEN Heavy Duty Railway Wheel Lathe, swing 6ft. by 12ft., vee belt drive. Weight 25 tons.
New **CAPITOL** 9¾in. Centre Lathe admitting 6ft. between centres.
FACEPLATE Lathe, 9ft. swing.
DEAN, SMITH & GRACE 9in. by 5ft. 6in. Centre Lathe.

GRINDING MACHINES

OLIVETTI Model R 4-500 plain cylindrical grinder (1953).
MOPCO Model RUP 108YW. Combination horizontal and vertical spindle toolroom hydraulic Surface Grinder, table 38in. by 11in. (1953).
ZENITH Model PH Horizontal Spindle Hydraulic, Surface Grinder, 24in. by 8in. (1953).
VICO (Swiss) Hydraulic Toolroom Universal Grinder 10in. by 30in. (1953).
CRAVEN Heavy Duty Roll Grinding machine with capacity for rolls 42in. dia. by 12ft. between centres and fitted with automatic cambering. Will take rolls up to 25 tons weight. Fully motorised machine of modern design. Weight 25 tons.
WALDRICH SIEGEN Roll Grinder. 36in. by 13ft. between centres.
LOTH Universal Grinder (new).
Two **CINCINNATI** No. 2 Tool and Cutter Grinding Machines.
COVEL No. 2 Tool and Cutter Grinding Machine.
IMPERIA Tool and Cutter Grinder, Model M6 AR. (1953).
MATRIX No. 16G Plain Straight Thread Grinder.
SCRIVENER No. 1 Centreless Grinder.
BLAKE No. 1 Tap Chamfering Machine (New).
MATRIX No. 6 Internal Thread Grinders 3in. by 10in.
HEALD Model 81 Sizematic Internal Grinder.
PETEWE Model 3D Profile Grinding Machine (Nearly New).

DIESINKING MACHINES

VICTORIA Duplomatic Hydraulic Copy Milling Machine, 8in. by 8in. (New).

DRILLING MACHINES

ASQUITH Model ODI Radial Drilling Machine 4 M.T.
PACERA ¼in. Bench Drill (New).
Two **ARCHDALE** 36in. Radial Drilling Machines. No. 4 M.T.
Various **ACIERA** Precision Bench Drills.

GUILLOTINES

BESCO 42in. by 10 s.w.g. Power Guillotine.
HANDS 4ft. by ¼in. Guillotine.
RHODES 6ft. by ¼in. Guillotine.

MILLING MACHINES

MILWAUKEE Model 5H Vertical Mill, dial type, high speed model with power down feed to head, table 94in. by 18in. (New price U.S. $36,680. This machine is in beautiful condition, offered at a fraction of replacement cost.)
FRITZWERNER Model 8101 Automatic Miller (1953).
EDGWICK No. 1 Horizontal Milling Machine 40in. by 10in. table.
DENBIGH Model No. C4 Horizontal Milling Machine.
SANT ANDREA Model U.F.O/5 Heavy Duty Horizontal Miller. 86¼in. by 19in. Table travel 67in. (1953).

. . . a few yards from Olympia and Earls Court

348-354 KENSINGTON HIGH STREET - LONDON - W. 14
WEStern 7031 (5 lines)

TATE

VICTORIA Junior Omnimil (New).
Two **ARCHDALE** 18in. Automatic Cycle Kneeless Production Millers.
VICTORIA Model V2 Vertical Mill (1956).
SOMUA Model FH2C Horizontal Miller table 67in. by 14¼in. (1953).
CUNLIFFE & CROOM No. 2 Vertical Mill (dial).
FACKS Thread Miller.
ARCHDALE 34in. Plain Horizontal Miller (nearly new).
BEAVER Model VRBP Vertical Miller (New).

PLANING MACHINES

STIRK 16ft. by 5ft. double column Planers, four toolboxes; modern machines with Lancashire drive (Two).
HOLROYD Plano Mill 17ft. 6in. by 9ft. 6in.

POWER PRESSES

RHODES 1-Ton Open Fronted Bench Press with flange motor and UDAL guards.
LEE & CRABTREE 15-ton Horning Press.
LEE & CRABTREE 20-Ton Horning Press.
LEE & CRABTREE 35-Ton Double Action Mechanical Press.
RHODES 150-Ton Double Sided, Geared, Adjustable Stroke Power Press (1956).
H.M.E. Model DCP3 70-ton Double Sided, Double Crank, Single Action Power Press.
Three New **MULLER** Model AMP 22-ton Power Presses.
Three New **MULLER** Model AMP 35-ton Power Presses.
Two New **MULLER** AMP 45-ton Power Presses.
Two New **MULLER** AMP 60-ton Power Presses. Open Fronted.
Two New **MULLER** AMP 80-ton Power Presses.

SHAPING MACHINES

BERRY 16in. Shaper.
BROOK 18in. Shaping Machine.
KLOPP 22in. Shaping Machine.
TORPEX 22in. Shaping Machine.
New **LIMA** 22in. Shaper.

SAWING AND FILING MACHINES

WESPA AS4 Bandsawing and Bandfiling Machine, hydraulic feed (similar Do-all V/16).

WATCHMAKERS' MACHINES

MIKRON No. 79 Gear Hobber (almost new).
SAFAG Model 24 Cutter Relieving Machines.
LAMBERT Model 66 Gear Hobber.

Modern Machine Tools Ltd

USED MACHINES

MILLING MACHINES

RECONDITIONED CINCINNATI 2MH Universal. Speeds 23-1,200 r.p.m. Table 53in. by 10¼in. Power feeds in all directions.

RECONDITIONED CINCINNATI No. 4 Horizontal. Speeds 18-1,300 r.p.m. Table 86¼in. by 16in. Power feeds in all directions.

ARCHDALE 28in. Horizontal. Speeds 30-462 r.p.m. Table 49in. by 13in. Power feeds in all directions.

MILWAUKEE Model 1H Horizontal. Speeds 35-1,400 r.p.m. Table 40in. by 9in. Rapid traverse in all directions.

REED PRENTICE Model 3VG Vertical. Speeds 110-2,200 r.p.m. Table 36in. by 10¼in. Power feed to table only.

LATHES

REBUILT SMART & BROWN Model 'A' Lathe 4¼in. Centre Height. 9¼in. swing. 20in. between centres. Speeds 39-1,430 r.p.m.

DEAN, SMITH & GRACE Type 13Z 6¼in. S.S. & S.C. Lathe. Straight bed. 30in. between centres. 1¼in. spindle bore. Speeds 89-889 r.p.m.

LANG 8¼in. S.S. & S.C. Lathe. Straight Bed. 36in. between centres. 1⅝in. spindle bore. Speeds 19-900 r.p.m.

NEW MACHINES IN STOCK OR FOR EARLY DELIVERY

MYFORD MG.12 Grinders.

PACERA ¼in., ⅜in., ⅞in. & 1in. Drilling Machines.

VICTORIA O.2 Omnimils, U.2 & U.2R Milling Machines.

ARNO Millers.

BEAVER Millers.

ELLIOTT 7½in. Lathes.

HARRISON 8in. and **BOXFORD** Lathes.

MITCHELL 8½in. and 12½in. Lathes.

COLCHESTER, CHIPMASTER, STUDENT & TRIUMPH Lathes.

SMART & BROWN 'A', '1024' Lathes. Toggle Presses & Screwing Machines.

TOWN A.E.4 & A.E.5 3ft. 6in. & 4ft. 6in. Radial Drills.

COMPREHENSIVE STOCK LIST AVAILABLE ON REQUEST

P.O. BOX No. 56 GOSFORD STREET COVENTRY Telephone : COVENTRY 22132-6 Cables : MODERN COVENTRY

MMT/SM6320/M

WIDDOWSONS

NAVALMECCANICA

13ft. by 5ft. by 4ft. Planing Machine, three tool boxes, brand new ex manufacturer. Quick delivery.

'UNION' BFT. 63

Horizontal Boring and Facing Machine, 2½in. dia. spindle, Speeds 4 to 1,400 r.p.m.

ARCHDALE

5ft. Heavy Duty Low Base Radial Drilling Machine. Nearly New

KENDALL & GENT.

Plano Milling Machine, with Vertical Head, 4ft. by 4ft. by 4ft. long, Speeds 12 to 700 r.p.m.

HERBERT WIDDOWSON & SONS LIMITED

Canal Street Works, Nottingham · Telephone : 51891 (4 lines)

MEMBER OF B.A.M.T.M.

Classified Advertisements (*PLANT FOR SALE, contd.*)

MIDLAND

BENDING ROLLS

RHODES 6ft. × 14 Gauge Power Bending Rolls.

CROPPING MACHINES

Double Ended Angle Cropping Machine. Cap. up to 6in. × ½in. angles.

DRILLING MACHINES

American 6ft. H/Duty Radial Drill No. 6 Morse Taper. Older machine, good condition. 400/3/50 sep. motor.

FOLDING MACHINES

EDWARDS 6ft. × ¼in. High Lift Swing Beam, Universal Folder.

GRINDING MACHINES

New **N.I.** 10in., 12in., 14in., 16in. and 20in. D/E. Tool Grinders.
ABRASIVE No. 34 24in. × 8in. Vertical Spindle Surface Grinder.

GUILLOTINES

RUSHWORTH 4ft. × ¼in. O/Crank Guillotine. Little used.

KEYSEATING MACHINES

EDGWICK Keyseater. Stroke 4½in. Table 26in. × 9in.

LATHES

HERBERT No. 4 Capstan. 2½in. H/Spindle Speeds-511

MILLING MACHINES

EDGWICK No. 2 Horizontal Miller. Table 46in. × 11in.
MILWAUKEE 3H. Vertical Milling Machine.

NIBBLERS

BURFREE 2A Nibbling Machine. Cap. ¼in. M/S.
W.F. 14 Gauge Nibbler. 59in. Throat.

PRESSES

TAYLOR & CHALLEN " 370 " 20 ton O/F Press.
TAYLOR & CHALLEN " 845 " Dial Feed Notching Press. Cap. 6 tons.
TAYLOR & CHALLEN " 1455 " Dial Feed Notching Press. Cap. 2 tons.
BRADLEY & TURTON No. 3 Flypress.
SWEENEY & BLOCKSIDGE Bench Press. Cap. 3 tons.

SAWING MACHINES

BARSON No. 1 Saw. 1¾in. rounds, 2in. tubes, 1¾in. × ¼in. flats, 1¾in. × ¼in. angles.

SCREWING MACHINES

KENDALL & GENT 3in. Screwing Machine. Leadscrew Type.

SHAPING MACHINES

TOWN 26in. H/Duty Shaper.

POLISHING MACHINES

3 and 5 h.p. Double Ended Polishing Spindles.

WELDING EQUIPMENT

PRESCOTT 15 kVA Spot Welder.
All machines 400/3/50 electrics unless otherwise stated.

THE
MIDLAND MACHINE TOOL CO.
BRADLEY, BILSTON, STAFFS.
Tel.: Bilston 42471/9

FRYE

POYLE ROAD, COLNBROOK
SLOUGH BUCKS

PRICED STOCK LIST OF USED MACHINE TOOLS

GRINDERS

CHURCHILL 18in. by 72 in. Plain Grinder. **£975.**
LANDIS 12in. by 48in. Hydraulic Universal Grinder with internal Spindle. **£975.**
COVENTRY Matrix 21 Thread Grinder. **£650.**
CHURCHILL 20in. by 84 Plain Grinder with throw blocks for crankshaft grinding. **£2,850.**
TRIDENT 18in. by 6in. Surface Grinder with P.M. Chuck. **£235.**
ABRASIVE No. 5 Hydraulic Surface Grinder. 42in. by 12in. table complete with magnetic chuck. **£1,250.**

CAPSTANS—LATHES—AUTOS

WARD 2A Capstan. Bar and Chuck Machine. **£585.**
LANG 10in. by 60in. S.S. & S.C. Straight bed Centre Lathe. **£950.**
HILLE 1¼in. Capstan speeds to 1,200, feeds to turret and cross slide. hob and drag screwcutting. **£685.**
SPRINGFIELD 36in. Surfacing, Boring and Screw Cutting Lathe. **£830.**
WARD O.E. Capstan. **£385.**
SOUTHBEND 6¼in. Centre Lathe. with Taper Turning Draw-bar and Collets. **£375.**
ASTRA Surfacing and Boring Lathe. 16in. Swing by 20in. B.C. **£110.**

SHEET METAL MACHINERY

150 ton 10ft. by ⅜in. Press Brake with Fraser Mono Radial. 30 H.P. pumping unit. **£2,750.**
150 Ton Press Brake. **£2,250.**

MILLERS

Two **STEINEL** Model SH4D Horizontal Milling Machines. 30in. by 8in. Table. **£500 ea.**
ADCOCK & SHIPLEY No. 3 Horizontal Miller, with vertical attachment. 50in. by 12in. Table speeds to 1,400. **£395.**
RICHMOND MVI Vertical Miller, table 30in. by 10in. Speeds to 1,000. **£285.**
PALLAS 40in. by 10in. M.D. all geared Universal Miller. **£395.**
ADCOCK & SHIPLEY Vertical Mill. Table 13in. by 5in. Speeds 150-3,000 (Excellent). **£285.**
CINCINNATI No. 2 Plain Mill. Table 50in. by 12in. **£350.**
WICKMAN MOULTON Thread Miller. 6in. by 24in. **£285.**

BORERS & DRILLS—TAPPERS

WEBSTER & BENNETT 36in. Hi-power Vertical Borer. **£975.**
ASQUITH 3½in. Floor Borer, spindle speeds 5.6-350. Screw cutting 3-12 T.P.I. **£3,250.**
PROGRESS 4E Pillar Drill. **£150.**
HULLER UG3 Radial Arm Tapper. **£285.**

FRYE MACHINE TOOL COMPANY LTD.
Telephone: Colnbrook 2442/3/4
(4 minutes from London Airport)
Open Saturday Mornings

Asquith type H.D.P. two-spindle Profile Milling M/c. Adjustable cross-rail. Ind. motor drive to each spindle. Capacity 24in. × 28in. Spindle speeds 250-3,000 r.p.m.—LEE & HUNT LTD., Crocus Street, Nottingham. 'Phone 84246.

Cincinnati No. 2 M.H. Plain Horizontal Milling Machine, W.S.O.T., 7in. × 44in.
Further details from —
C. & G. OLDFIELD, LTD.,
15, Abercorn Street,
PAISLEY.

Footburt 1½in. Single Spindle Automatic. 400/3/50.—HICKS MACHINERY, LTD., 26, Addison Place, London, W.11. Tel.: PARk 2333.

C.V.A. Automatics, No. 12 Ser. 121013, capacity ¾in., gears, barfeed, No. 8, Ser. 31562, capacity ¼in., gears, barfeed. Ex. cond.—C. L. THOMAS, LTD., Stirling Road, Solihull. Tel.: 3075-6.

Adcock & Shipley 5-spindle Drill, ¾in. cap., adjustable drill heads.—A. McNAMARA & CO., LTD., New Line, Bacup, Lancs. 'Phone: Bacup 946.

New Stanley 8¼in. Centre Lathe, 2 Speed Model, complete with Chucks, etc.
Further details from:
C. & G. OLDFIELD, LTD.
15, Abercorn Street,
PAISLEY.

Classified Advertisements (*PLANT FOR SALE, contd.*)

Cashmores

Selection of Machine Tools from Stock

CENTRE LATHES

New **WILLSON** Mark 1 6½in. Sloping Bed Lathe, A.G.H. S.S. & S.C. Gap Bed to admit 2ft. 6in. between centres.
MITCHELL OF KEIGHLEY 8½in. S.S. & S.C. Lathe to admit 4ft. 3in. between centres.
MITCHELL OF KEIGHLEY 10½in. S S. & S.C. Lathe to admit 4ft. 0in. between centres.
VOLMAN 8in. S.S. & S.C. Gap Bed Lathe to admit 4ft. 6in. between centres.

BORING MACHINE

WEBSTER & BENNETT 36in. Vertical Boring Mill, table speeds 5.6/125 r.p.m.

DRILLING MACHINES

ARCHDALE 5ft. Elevating Arm Radial Drilling Machine, No. 5 M.T. spindle.
New **RICHMOND** Model SR.2 3ft. 0in. Radial Drilling Machine. Fixed arm No 3 M.T. spindle.
SWIFT 4ft. 6in. Model A1 Elevating Arm Radial Drilling Machine, No. 4 M.T. spindle, motorised 400-440/3/50 cycles.
New **KITCHEN-WALKER** 4ft. 6in. Radial Drilling Machine, No. 5 M.T. spindle.

GRINDING MACHINES

BROWN & SHARPE No. 5 Horizontal Spindle Surface Grinding Machine, 24in. × 8in. capacity, hydraulic feed to table.
JONES & SHIPMAN Vertical Spindle Surface Grinding Machine, 18in. × 6in., hydraulic feed to table.
NORTON 6in. × 30in. Hydraulic Plain Cylindrical Grinding Machine, maximum wheel diameter 20in.

MILLING MACHINES

CINCINNATI No. 4 Horizontal Plain Milling Machine, 78½in. × 16in. table.
HYPERMILL 7/27 Production Type Milling Machine, 43in. × 10in. table.
MIDGLEY & SUTCLIFFE Hand Lever Feed Milling Machine, 16in. × 5in. table.
EDGWICK No. 2 Dial Type Plain Horizontal Milling Machine, 46in. × 11in. table.
ARCHDALE 20in. Dial Type Horizontal Milling Machine, 40in. × 12in. table.
GREENWOOD & BATLEY Plain Horizontal Milling Machine, working surface of table 20in. × 10in.
EDGWICK 18in. Horizontal Plain Production Milling Machine, with 40in. × 12in. table.

POWER HAMMERS

ALLDAYS & ONIONS 2 cwt. Clear Space Type Pneumatic Power Hammer.
MASSEY 5 cwt. Pneumatic Side Type Power Hammer.

SAWING MACHINES

New **WICKSTEED** 10in. capacity Power Hacksaw.
New **STARTRITE-SABRE** Vertical Metal Cutting Bandsaw, 20in. throat.

SLOTTING MACHINES

BUTLER 14in. stroke All Geared Slotting Machine with 39in. diameter rotary table.
DUTRANNOIT 24in. stroke Precision Slotting Machine with swivelling head, 39½in. table.

SHAPING MACHINE

New **INVICTA** 24in. and 18in. stroke Shaping Machines.

SHEARING MACHINE

New **KEETONA** 8ft. 0in. × ¼in. Undercrank Guillotine Shearing Machine.

STRAIGHTENING ROLLS

BRONX 8ft. 0in. × ¼in. Straightening Rolls, 5 roll type.

All the above machines are motorised 400-440/3/50 cycles.

JOHN CASHMORE LTD.
NEWPORT 1, MON.
Tel. Newport 66941 (6 lines).

SALES ENTERPRISE LTD.,
FOR
NEW MACHINE TOOLS
EARLY DELIVERY

LATHES

	DELIVERY
CARDIFF 7¼in. × 40in. b.c. "Major"	Sept.
CARDIFF 9¼in. × 48in. b.c. "Prefect."	Sept.
CARDIFF 11in. × 48in. b.c. "Crusader."	Sept.
BROADBENT 8¼in. × 48in. b.c. "Vee" Bed.	Sept.
BROADBENT 10in. × 72in. b.c. "Vee" Bed.	Sept.
BINNS & BERRY 12¼in. × 90 in. b.c	Sept.
COLCHESTER 8¼in. × 54in. "Mascot."	Sept.

MILLERS

VICTORIA Rapidmil No. 2 Universal, table 48in. × 11¼in.	Stock
VICTORIA U.3 Universal, table 60in. × 12¼in.	Sept.
MAS FU2A Universal, table 53in. × 12in.	Stock
VICTORIA V.3 Vertical, table 60in. × 12¼in.	Sept.
RICHMOND No. 3 Vertical, table 48in. × 11in.	Sept.
AULBRACH Hand Lever Horizontal, table 16in. × 5in.	Stock
BEAVER VBRP Turretmil, table 44in. × 10in.	Sept.
VICTORIA T.V.1 Turretmil, table 36in. × 10in.	Sept.

JIG BORERS

OMEGA No. 2 High Precision Jig Boring Machine, table size 32in. × 20in., long traverse 24in., cross traverse 16in. spindle speeds 50-2,000 r.p.m. Fitted with power elevating unit to spindle head. **£2,891 0 0.** *Details on request* Oct.

GRINDERS

EXCEL No. 1, table 10in. × 5in., Surface Grinder.	Stock
RIBON RUR 500 Universal, cap. 10in. × 20in.	Sept.
UNION Carbide Tool Grinder.	Stock
UNION G.25, table 16in. × 6in., Tool and Cutter Grinder.	Stock
BURDETT 18in. × 6in. Surface Grinder.	Nov.
BURDETT 24in. × 8in. Surface Grinder.	Oct.
ELB 40in. × 12in. Surface Grinder.	Oct.
MYFORD MG12 Cylindrica Grinder.	Oct.

DRILLS

RICHMOND HB3/12 2in. cap. Radial.	Stock
PROGRESS 3A 1¼in. capacity.	Stock
PROGRESS 5E 2in. capacity	Stock
IMA 1¼in. capacity.	Stock

SHAPERS

INVICTA "Major" 30in., auto down feed, etc	Stock
ALBA 6S 24in., swivel table.	Stock
ALBA 4S 18in., swivel table.	Stock

BANDSAWS

STARTRITE "Metalin" Horizontal, cap.	12¾in. Stock
STARTRITE "Meba" Horizontal, cap.	10in. Stock
Q. & S. 6in. Sawmaster hacksaw.	Sept.
Q. & S. 8in. Sawmaster ,,	Sept.
STARTRITE "Sabre" Bandsaw, throat.	20in. Sept.
STARTRITE "Volant" Bandsaw throat.	18in. Sept.

EQUIPMENT EX STOCK

Bench and Pillar Drilling Machines, Bench Grinding Machines, Rotary Milling Tables, Dividing Heads, Machine Vices, etc.

274 MANCHESTER ROAD,
AUDENSHAW, MANCHESTER
Tel. No.: DROylsden 1335/6.

TIMES MACHINERY

A SELECTION OF NEW MACHINES AVAILABLE FOR IMMEDIATE DELIVERY

DRILLING MACHINES

¾in.-2¾in. cap. IM High Speed Bench Drills.
1in.-1¾in. Pillar Drills.
MEX 1¾in. capacity 32in. Radial Arm Drilling Machine.
BREDA 1¾in. capacity 36in. Radial Arm Drilling Machine.

GRINDERS

12in. × 8in. Horizontal Spindle Surface Grinder.
50in. × 11¾in. Vertical Spindle Surface Grinder.
12in. × 6in. Vertical Spindle Swing type Bench and Column Grinders.
12in. and 16in. Wheel, Table type Surface Grinders.
10in. × 40in. Universal Grinder.
1in. capacity Centreless Grinder.
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If you do not wish your reply to any Box No. advertisement in this section to be forwarded to certain firms, please advise us. Your reply will then be destroyed, but you will not be notified as this would disclose the identity of the advertiser.

Ministry of Aviation requires ENGINEER III at the Electrical Inspection Department, Royal Ordnance Factory, Cardiff, to supervise, under an Engineer II, large inspection team engaged in the metrology of mechanical components of unusual design. *Qualifications and Experience.* Should have served recognised Engineering apprenticeship and be corporate members of one of the Institutions of Civil, Mechanical or Electrical Engineers or have equivalent qualifications. Good knowledge of advanced metrology and knowledge of the principles of inspection control in precision engineering desirable. Salary: £936 (age 25) to £1,430 p.a. National Scale. Commencing salary £1,258 at age 34 and over. Not established but opportunities to compete for establishment may arise. Forms from Ministry of Labour, Technical and Scientific (K) Register, 28 King Street, London, S.W.1, quoting C.521/1A. Closing date, 6th September, 1961.

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Write giving age and experience to BOX D188, MACHINERY, Clifton House, Euston Road, N.W.1.

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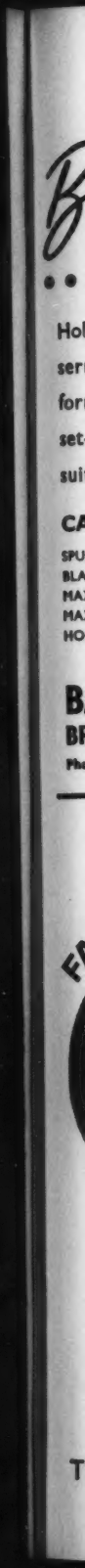

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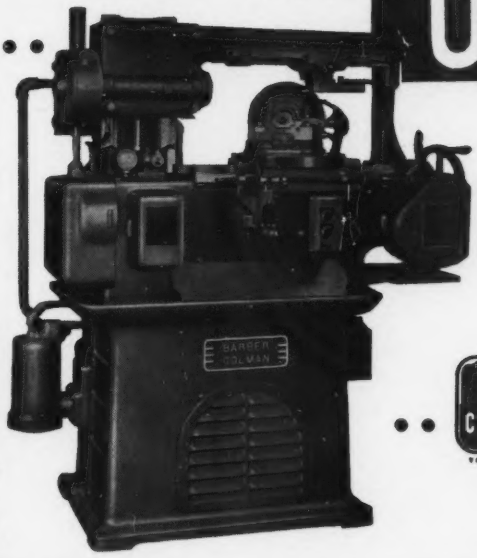

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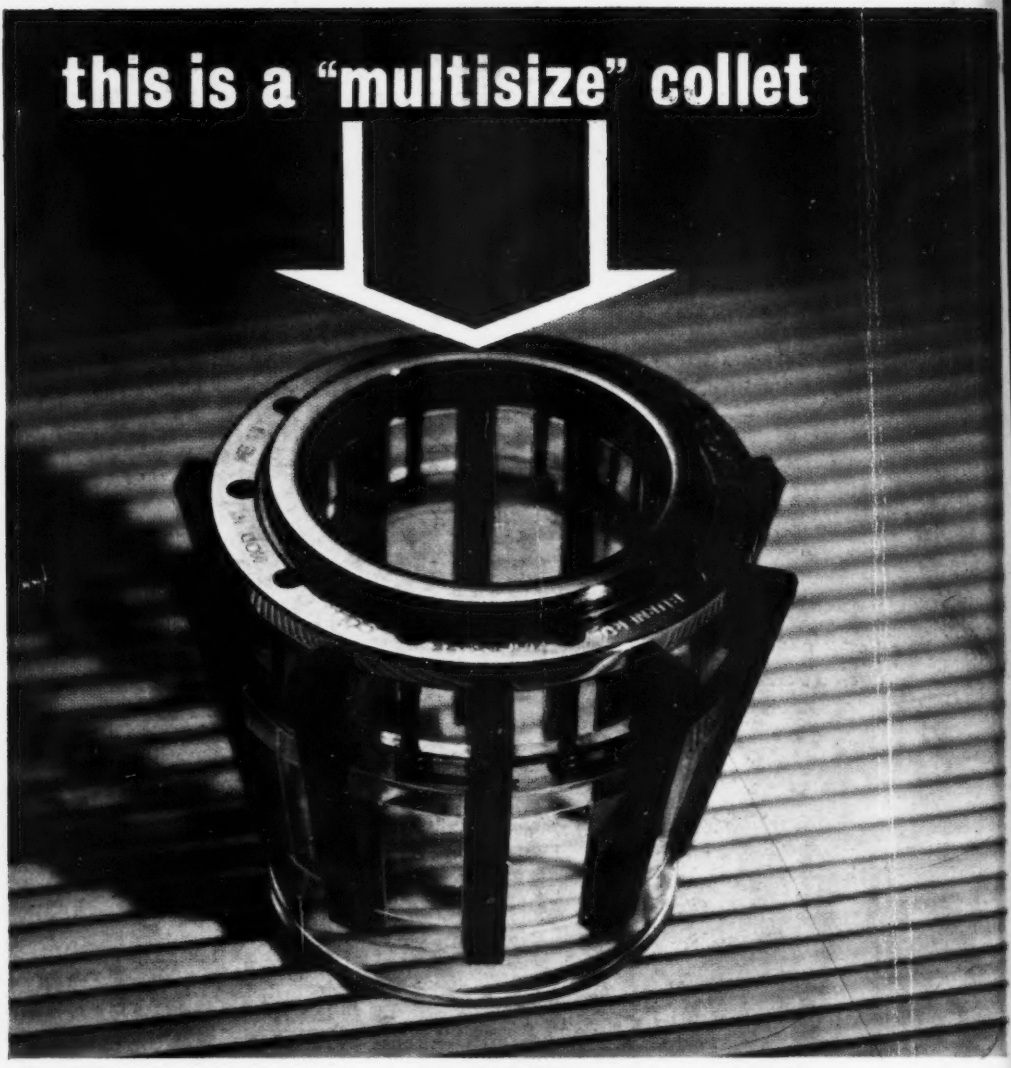

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